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DISEASES OF THE URINARY APPARATUS.

PHLEGMASIC AFFECTIONS.

DISEASES

OF THE

URINARY APPARATUS

PHLEGMASIC AFFECTIONS

BY

JOHN W. S. GOULEY, M.D.
SURGEON TO BELLEVUE HOSPITAL

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PREFACE.

The twelve lectures, principally on phlegmasic affections of the urinary apparatus, constituting the first part of a series, delivered during the autumn of 1891, and published in the New York Medical Journal, having been revised, are republished in this form as a contribution to the pathology and treatment of a class of diseases the gravity and frequency of which render them worthy of the closest study.

The views expressed in these conferences are based upon long observation of morbid processes, frequent comparison of the effects of different means of cure, and careful examination of foreign and American works on andrology.

Owing to the almost incessant advances in patho-histology, bio-chemics, and therapeutics, many of the conclusions herein stated may be regarded as only provisional.

324 Madison Avenue, New York, March, 1892.

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DISEASES OF THE URINARY APPARATUS.

PART I.—PHLEGMASIC AFFECTIONS.

SECTION I.—*GENERAL CONSIDERATIONS.*

I.

INTRODUCTION. — FREQUENCY OF DISEASES OF THE URINARY APPARATUS.—SKETCH OF THE COMPOSITION, INNERVATION, NUTRITION, AND FUNCTION OF THE URINARY APPARATUS.

THE present knowledge of affections of the urinary and genital apparatus, and of means for their relief, is the accretion of the experiences of many thousand years. All nations and generations have contributed their quota in the slow but steady advances that have been made. It requires no great stretch of the imagination to picture a young savage, far back in the mists of time, harassed by frequent and difficult urination owing to a narrow stenosis of the preputial orifice, conceiving the idea of sharpening a stone and with it excising the end of the prepuce, and thus removing the annoying obstruction. This prompt relief inducing him to try the experiment upon others, he becomes the posthectomist of his tribe. An aged savage, too, may be pictured in the throes of retention of urine searching means of relief, and finding a smooth, hollow reed, rounds its extremity, spits upon it, performs rectilinear catheterism, and relieves his distended bladder. He then exhibits with joy the improvised instrument that has saved him, and perhaps also an improvement thereon, and his elderly neighbors, similarly affected, take advantage of the discovery.

The following statement is made to show that autocatheterism with a reed is not purely imaginary, but has been successfully practiced for the relief of retention of urine: A Tasmanian, under the care of the writer for urethral stricture, said that while in his country far away "in the bush" he was seized with retention of urine, and suffered so much in consequence that he looked for and found a reed of suitable size, which, after a little rude preparation, he moistened with saliva and introduced into his urethra, and thus relieved his distended bladder. The writer is in possession of two small straight rods made of bamboo, smoothed, rounded, and charred at both extremities. These rudely improvised instruments had been used for several months by another patient, a rustic, almost a savage, for the relief of frequent attacks of retention of urine due to urethral stricture. He said that he had prepared them himself, and that whenever unable to urinate he introduced the smaller and then sometimes the larger, immediately on whose withdrawal the urine flowed freely.

The operation of posthectomy appears to have been commonly practiced by several ancient Eastern nations, notably the Egyptians, who were in the habit of performing the operation for the cure as well as the prevention of disease thousands of years ago.

Another operation, orchidectomy, whose invention is ascribed to Semiramis, the Assyrian queen, may be traced to savage life, and even the savages may have learned it from the lower animals, for there are not few of the smaller polygamous beasts that destroy the testicles of the superfluous young males. So it would seem that eunuchism is not confined to man. Many therapic devices, too well known to require present commentary, have been learned from the lower animals.

It is recorded that the cannibal Caribs discovered by Columbus were in the habit of emasculating their young prisoners to be fattened and then devoured.

Lumbar incision to let out pus from nephric or perinephric abscess dates back more than two thousand years.

The time when was introduced the cutting open of the bladder for the extraction of a stone is unknown. That it was habitually performed during the life of Hippocrates is evidenced in a clause of the oath which this great master caused his disciples to take, forbidding them to practice the operation, and relegating it to specialists.

Lithoclastic cystotomy is attributed to Ammonius, of Alexandria, who lived two hundred and seventy-six years before the Christian era and was surnamed Lithotomos, stone-cutter, from which arose the term lithotomy, now having the arbitrary signification of cutting for the stone.

Celsus first described the manner of using catheters for the relief of retention of urine, and the general directions he gave are followed to this day. Of late years bronze catheters have been unearthed from the ruins of Pompeii. This discovery, together with the account of them given by

Celsus, shows that these instruments were in common use before the Christian era.

It was Celsus, too, who gave the first description of lithotomy as performed before and during his time, and the operation has ever since borne his name—the Celsian method.

The greatest advances made in andrology are due to the endeavors to improve lithotomy, and later to discover other means of relieving sufferers from calculous affections. These improvements were begun in Italy, but the names of those surgeons who made them have long since been forgotten, and no writing has been found anterior to Mariano Santo (1525), who seems to have been the mouthpiece of his master, Giovanni di Romani. The method described is known as the Marian. The proprietary operation then passed into the hands of the Colots of France, remained a family secret for more than a century, and was not divulged until a surgeon, concealed in an upper room, surprised them in the act of operating, by looking through a hole in the floor. Franco had, however, already (1561) devised and published two methods of his own, one of which was the suprapubic.

From the time of the Colots lithotomy became a common operation in Europe; it became still more common on the advent of Frère Jacques, who is said to have operated more than five thousand times. The frequent use of the sound in searching for vesical stones led to the better study of urethral obstructions and finally to the specialization of urethral strictures.

Still further advances were made in the eighteenth century, but a gigantic step was taken almost from the moment of the introduction of lithotripsy (1824), which required the most careful study of the urethra and of those lesions of the upper urinary organs that so often contraindicate surgical interference. With lithotripsy and the advances it suggested are connected the names of the most diligent laborers in surgery of Europe and America. Despite this great progress, there remains much to be done toward improving the present knowledge of the pathology and therapy of these affections by succeeding generations of physicians, and the future advances will be proportionate to improvements in methods of study.

The main object of the proposed conferences is to outline what is conceived to be a direct and convenient method of studying the diseases that affect the urinary apparatus, and incidentally to point out the degree of responsibility assumed by the physician when he undertakes the management of any disease of this apparatus, and also his obligation to acquire an adequate knowledge of the normal and morbid anatomy and therapeutics of the urinary organs. The material requisite to this adequate knowledge is gathered from the study of medical and surgical treatises, from the observation of cases of disease, and from written and oral conferences, the object of such conferences being ordinarily to convey information in part gleaned from trustworthy sources, notably those that are not of easy access to the majority of readers, and in part derived from close observation and extended experience. In other words, these conferences, to be time and labor saving to the listener, should consist mainly of conclusions arrived at by the writer or speaker from the analysis and synthesis of his experience as well as the recorded experiences of others.

To carry out the legitimate purposes of these conferences will be to present, in the form of condensed disquisitions, the results of a careful examination of questions relating to the pathology, ætiology, symptomatology, diagnosis, and treatment of abnormal conditions of the male urinary apparatus that come within the province of surgeons.

FREQUENCY OF DISEASES OF THE URINARY APPARATUS.—It may be safely asserted that two thirds of the male inhabitants of large cities, from early infancy to extreme old age, suffer from some affection of the urinary or of the genital apparatus; that half of the adult males have had urethritis; and that at least half of all men above the age of fifty suffer from some disease of the bladder or prostate. Hence the importance of their special study.

The urinary and genital organs are primarily or secondarily affected by disease or by injury—that is to say, a disease may begin in one of the organs, and another organ may suffer secondarily from this disease; and if an organ be injured, another organ may, in consequence, become involved in disease. Again, some disease originating in a distant part of the body may disturb the function of the apparatus, and even cause disease of several of the urinary organs. For example, any disease or injury which seriously impedes the outflow of the urine reacts upon the bladder, ureters, and kidneys. Certain abnormal states of the digestive apparatus are known to give rise to hyperlithuria and glycosuria, the latter being sometimes caused by grave cerebral disease. Excessive lithuria causes irritation and even inflammation of the ureters, bladder, and urethra. Long-continued polyuria often causes renal and vesical disease.

Many of the diseases of the urinary organs are curable, and the most hopeless are amenable to palliative treatment, designed to relieve pain and prolong life.

Inasmuch as a correct conception of disease can not be formed without previous study of the nature and uses of the organs of the human body—disease being a departure from the normal state of any of these organs—it is wise to bestow more than ordinary attention upon the anatomy and physiology of the urinary and genital apparatus, and thus to take a forward step in the direction of exactness in diagnosis and success in treatment. Only a part of the required knowledge can be obtained from the perusal of works on anatomy and physiology and of treatises on the normal and diseased urinary organs; the remainder is to be gained solely from the cadaver, used with two objects: first, to learn practically the descriptive, relative, and morbid anatomy of these organs; and second, to rehearse all needed operations, even simple catheterism.

Since a dissertation on special anatomy and physiology would here be out of place, a simple sketch will be given of the composition, innervation, nutrition, and function of the urinary apparatus as an introduction to the description of diseases which are to be studied, referring the student, for further information, not only to works on anatomy and physiology, but to the anatomical laboratory.

COMPOSITION OF THE URINARY APPARATUS.—The urinary apparatus consists of the kidneys, the ureters, the bladder, the prostate, and the urethra. The kidneys excrete the urine which, after a short detention in the renal pelves, is conveyed through the ureters—whose caliber, narrow at each extremity of the duct, averages three sixteenths of an inch, and whose length ranges from twelve to fifteen inches—to the bladder, whence, after longer detention, it is finally expelled through the urethra. Some of the organs of the urinary apparatus are common to the genital apparatus—namely, the prostate and urethra—and all of them, except the kidneys, are in close relation with most of the genital organs.

The genital apparatus consists of the testicles, the spermatic canals, the seminal vesicles, the prostate, the bulbo-urethral glands, the urethra, and the penis.

Of the organs of the urinary and genital apparatus, the kidneys, ureters, bladder, prostate, and seminal vesicles are intra-abdominal; the urethra and spermatic canals are partly within and partly without; while the penis and testicles are external.

Inasmuch as many of the diseases of the upper urinary organs are consequent upon urethral affections, and inasmuch as the diseased urethra in its divers parts requires modifications in treatment, it is necessary, for practical purposes, that these several parts be specialized. A simple division into the six following regions seems sufficient for this end: 1. The prostatic region: that part of the canal which traverses the prostate in its longitudinal axis, from the urethro-vesical orifice to the prostatic apex. 2. The membranous region: that part of the canal which is between the two layers of the triangular ligament, from the apex of the prostate to the urethral bulb. 3. The perineal region: that part of the canal which is in the perinæum, from the anterior face of the triangular ligament to the posterior limit of the scrotum. 4. The scrotal region: that part of the canal which is covered by the scrotum. 5. The phallic region: that part of the canal which begins at the peno-scrotal junction and ends at the base of the glans penis. 6. The balanic region: that part of the canal which extends from the base of the glans penis to the external urethral orifice.

These organs are so intimately associated and so interdependent that disorders of any of the urinary organs often cause some derangement of the others and react upon the genital organs, and sometimes also upon the whole organism. This happens partly through the vascular system, partly through the medium of the nervous system.

INNERVATION OF THE URINARY APPARATUS.—The urinary, like the other organs of the human body, derive their innervation from both the sympathetic and cerebro-spinal nervous systems—the one presiding over nutrition and excretion, the other over motion, sensation, and intellection; the two freely intercommunicating by many branches, and the sympathetic following the cerebro-spinal system throughout the body and supplying the muscular fibers and the blood-vessels to their utmost ramifications. The double prevertebral chain of sympathetic ganglia, besides sending communicating filaments to the nerves of the cerebro-spinal system, forms separate ganglia in the thoracic and abdominal cavities, such as the semilunar, which give off the solar plexus and superior and inferior hypogastric plexuses for the supply of the abdominal and pelvic viscera. From the sacral plexus of spinal nerves arise the great sciatic nerve, and the internal pudic, which sends a branch to the penis, one to the bulbo-cavernosus muscle, and one cutaneous branch to the scrotum and to the lower surface of the penis. These systems of nerves are conducting media for the transmission of impressions to the great centers.

When, from disease or injury, either nervous system is impaired, the function of the urinary apparatus is disturbed in a degree proportionate to the lesion of the nerve center. For example, in a case of compression of the brain where sensation and volition are null, the bladder becomes gradually distended with urine; the patient receives no warning of the fact, as he should through his sensory nerves if their action had not been interrupted; he does not experience the need to urinate and can make no complaint of pain and cry out for relief—so the urine continues to accumulate to the point of greatly overdistending the bladder. If he regain consciousness, he may soon have an urgent desire to urinate without, however, the ability to do so, and this may continue for days or weeks after the bladder has been relieved artificially. This disability is the result of direct injury to the bladder—*i. e.*, the mechanical distention to which it has been subjected owing to accumulation from a cessation of the desire to urinate. In such a case the vesical nerves have doubtless suffered from overstretching, but the muscular coat of the bladder has received, from this same cause, the greater injury, hence the length of time required for the restoration of normal urination. In ordinary complete paralysis there should be incontinence and not retention of urine—that is to say, the urine should escape from the bladder as fast as it oozes from the ureters.

A proper appreciation of the intimate relations that the urinary organs bear one to another through their supply of nerves enables the student, in a measure, to explain the phenomena to which their derangement may lead. For instance, retention of urine in the bladder often causes severe griping pain in the intestines and sometimes obstinate vomiting. Nephritic colic, stone in the bladder, and cystitis give rise to similar symptoms. The introduction of a catheter into the urethra is occasionally followed by alarming symptoms which appear to be due to shock propagated through the medium of the sympathetic nervous system whose ramifications permeate the whole body. Another phenomenon well worthy of notice is an obstinate spasmodic cough during the process of catheterism in certain neurotic subjects, which cough ceases as soon as the catheter is withdrawn. Even the act of normal urination is at times accompanied by a shiver which, in some cases, is greatly exaggerated.

Bearing in mind that the nerves of motion and sensation derived from the cerebro-spinal system also supply the urinary organs, it is easy to account for certain urinary neuroses which sometimes occur in parts of the body distant from these organs, such as the feet, legs, anterior crural, sciatic, and lumbar regions. These neuroses have long ago been recognized by surgeons as symptoms of disease of the urinary organs.

NUTRITION OF THE URINARY APPARATUS: *Vascular System.*—Certain arteries carry red blood to the urinary organs for their nutrition, as well as for the supply of materials to be eliminated; certain veins carry away the blood when it has become charged with effete matter; and certain lymphatic, absorbent vessels collect from the mucous surface of the alimentary canal nutrient substances, and from the tissues of the organs gather both effete and morbid materials and carry them away, some in solution, others in suspension, in a milky fluid, called lymph or white blood, which is poured into the venous torrent.

The arteries that supply the urinary and genital organs are derived from the abdominal aorta, as the renal and spermatic; and from the internal iliac, as the umbilical, inferior vesical, middle hæmorrhoidal, obturator, and internal pudic.

The renal or emulgent arteries, nearly as large as the cœliac axis, are given off at right angles by the abdominal aorta at a short distance below the superior mesenteric artery, and are especially remarkable for their large caliber relatively to the size of the kidneys which they supply.

This anatomical disproportion is in obedience to a physiological law which requires the supply of blood to be adequate to the excretory activity of the organ. The kidneys excrete from two and a half to three pints of urine in every twenty-four hours; hence the very large caliber of their arteries. The renal arteries send but few and small collateral branches to the suprarenal capsules and to the celluloadipose capsules. The right renal artery is somewhat longer than the left, and arises a little lower down. At the hilum of each kidney the artery divides into several branches, some of which enter the organ between the basin and renal vein, others behind the basin, and, after further subdivision, penetrate the substance of the kidney between the cones of Malpighi, and go to form the capillary system of the cortical portion.

The unobliterated portions of the umbilical arteries give off superior, middle, and inferior vesical branches; other inferior vesical branches arise from the internal iliacs, and these branches are distributed to the lower fundus of the bladder, to the prostate, to the seminal vesicles, and to the spermatic canals. The middle hæmorrhoidal vessels send branches to the spermatic canals, the seminal vesicles, and to the posterior part of the bladder. The obturator arteries send a few lateral branches to the bladder. The internal pudic arteries, which are the terminal branches of the internal iliacs, give off the anterior vesical, and divide into the cavernous and the dorsal arteries of the penis, and, finally, into the arteries of the urethral bulb and the superficial perineal arteries.

The veins of the urinary and genital organs, with the exception of the renal veins, are supplied with valves. The caliber of all these veins is much greater than that of the corresponding arteries, but the walls of the veins are much thinner than those of the arteries.

The renal or emulgent veins are much larger than their accompanying arteries. The left vein is a little larger, longer, and more horizontal than the right, and receives the left spermatic vein. Each renal vein originates in the cortical substance of the kidney in a great number of venules. These unite to form larger branches, which converge at the hilum into a single trunk, destined to carry the blood to the inferior vena cava. The other veins of the urinary and genital organs terminate in the internal iliac veins.

The vesical veins, according to Gillette, consist of three plexuses—the submucous, the intermuscular, and the subperitoneal plexus. The submucous plexus is made up of venules from the capillary network of the mucous membrane. At the lower fundus of the bladder the meshes of this network are much closer than in other parts and overlie each other. At the vesical trigone and around the vesico-urethral orifice the network is most highly developed. This explains the abundance of the hæmorrhage which sometimes occurs after lithotripsy, and also the spontaneous vesical hæmorrhages which now and then occur in men of advanced years.

The intermuscular plexus arises in part from the venules of the muscular coats, and in greater part from the submucous plexus. The principal veins of the intermuscular plexus follow the course of the columns of the internal muscular layer.

The subperitoneal plexus comprises a large number of satellite veins which descend from the summit toward the lower fundus of the bladder. These veins are upon the anterior, posterior, and lateral portions of the bladder. They often cause troublesome hæmorrhage in epicystotomy. The anterior veins terminate in the plexus of Santorini, the posterior in the plexuses which underlie the seminal vesicles, and the lateral end in the lateral prostatic plexuses. In the lateral plexuses small calcareous concretions called phlebolites are frequently found.

The anatomical relations of the prostatic plexus and the large veins from the plexus of Santorini, which run along the sides of the prostate, should be borne in mind during the operations of lateral and bilateral lithotomy, for, in case the incision of the prostate should happen to be extended beyond its limits, an injury of the plexus would prove a source of serious hæmorrhage. This accident has occurred in the hands of skillful surgeons.

The veins of the urethra and penis pass under the pubic arch and open into and constitute some of the afferent vessels of the plexus of Santorini. These afferent veins are the dorsal vein of the penis and some veins from the cavernous bodies of the penis and from the bulb of the urethra. The anterior vesical veins, together with certain intrapelvic veins which also communicate with the obturator veins, are among the afferent veins of Santorini's plexus. The efferent veins of this plexus are comprised, says Sappey, in four groups. Two groups, composed of the largest veins, run along the sides of the prostate; the other two follow the ischio-pubic rami and constitute the origin of the internal pudic veins. All of these terminate in the internal iliac veins. The plexus of Santorini presents on section a coarse trabecular appearance, and the trabeculæ which are the walls of dilated veins are rich in smooth muscular tissue, which adds much to their strength.

Lymphatic vessels have been traced in all the urinary and genital organs except in the mucous membrane of the bladder and ureters. Some of these organs are much more bountifully supplied with lymphatics than others, notably the external organs.

In affections of the urethra, penis, and scrotum, the lymphatics play a most important rôle, and this fact should be kept alive in the mind of the surgeon. To convey an adequate idea of the extent of the lymphatic system of the external uro-genital organs, the following is abstracted from Sappey's *Anatomy:*

No part of the cutaneous surface is so rich in capillary absorbent vessels as the scrotum. These vessels take up such a considerable part in the formation of the scrotum that it seems to be almost exclusively composed of lymphatics. From this rich network emerge on each side of the median line ten or twelve lymphatic trunks, which pass obliquely in front of the spermatic cord and lose themselves in the inferior inguinal glands.

The superficial lymphatics of the penis originate in its integument, and are especially numerous in the prepuce; the radicles arising therefrom end in the trunks that run along the dorsum of the penis. The lymphatics of the glans penis are remarkable for their size and number, and are disposed in two layers—a superficial layer, consisting of capillary radicles, and a submucous layer, of larger radicles. Both layers are continuous, at the meatus urinarius, with the network of the urethral mucous membrane. The deep layer is the starting point of multiple trunkules which converge from before backward and from without inward toward the frenum, where they unite with other branches from the urethra, forming what is called by Panizza the lateral plexus of the frenum.

The capillary lymphatics of the urethra extend throughout its entire mucous membrane, forming a network which, at the meatus, is continuous with the absorbents of the glans penis. These lymphatic vessels and those of the glans converge to the lateral plexuses of the frenum which send trunks to the dorsum of the penis, these trunks being the afferent vessels to the inguinal glands above Poupart's ligament. This peculiar disposition of the lymphatics of the urethra and penis explains why venereal ulcerations so constantly show themselves on the sides of the frenum, and how the inguinal glands become involved; why urethritis begins so constantly in the fossa navicularis; why this affection, in certain individuals, is accompanied by tumefaction of the inguinal glands; how, after being very circumscribed in its inception, it generally extends from before backward to invade little by little the whole urethral canal; finally, how this same affection may extend itself to the testicles, for the seminal vesicles, the spermatic canals, and the testicles are not less rich in absorbent vessels than the glans and urethra, the same network being prolonged to the seminal tubes of the testicles. Therefore urethritis may be regarded as a veritable angeioleucitis.

THE FUNCTION OF THE URINARY APPARATUS consists in the excretion and expulsion of effete substances from the organism, these being separated from the blood by the kidneys, which then filter, also from the blood, a sufficiency of water to dilute and wash them from the uriniferous tubes into the calices and pelves of the ureters, thence into the bladder, where this composite fluid called the urine accumulates at the rate of from an ounce and a half to two ounces an hour and at length becomes a burden to the individual, who expels it voluntarily through the urethra. Thus is accomplished the terminal act of the function of urination. The proportion of excreta to the aqueous element, though variable, is ordinarily not far from one in twenty-four. The quality and quantity of urine excreted are subject to great variation in different persons, and at different times in the same person. A medium-sized, healthy adult male expels from his bladder from thirty-six to forty-eight ounces of urine, with an average of forty-two ounces, a day, urinating from four to six times during the period of twenty-four hours, and occupying about twenty seconds for each act of urination when the quantity of urine to be expelled does not exceed nine ounces. Young adults often retain eighteen and even twenty ounces of urine without inconvenience, and many men, up to the age of sixty, urinate only three times in the twenty-four hours, twelve or fourteen ounces each time. Ordinarily, any marked deviation in quantity, quality, frequency, or freedom of emission constitutes functional derangement, arising from extreme seasonal variations, improper alimentation, the ingestion of certain medicinal agents or of poisons, insufficient exercise, excess of exercise, mental perturbations, injuries, errors in the nutritive process, or organic diseases.

The season of the year exerts no little influence on the quantity of urine excreted by healthy subjects. In very cold weather the aqueous constituent of urine is increased, while in hot weather, the individual perspiring abundantly, it is decreased, the saline elements remaining the same, or very nearly so, in either case. In the first case the specific gravity of the urine is lessened, and in the second case it is increased. Urine of low specific gravity causes vesical irritation, with unduly frequent desire to urinate, and the same occurs in the case of urine of inordinately high specific gravity. Certain articles of diet, when freely used, are known to greatly increase the quantity of urine in healthy persons, notably the water-melon. In one instance, the juice of two pounds of water-melon having been ingested, three pints of urine passed in three hours at four acts of urination, each time giving rise to marked vesical and urethral uneasiness which lasted at least fifteen minutes. In view of these facts, persons suffering from renal disease should be cautioned against making too free use of aliments which possess diuretic properties.

Oliguria, to a moderate extent, is caused by the use of several of the food vegetables. Asparagus, for instance, when freely ingested, has been known to cause diminution instead of increase of the watery element of the urine, and there are other articles of food which produce the same effect.

Qualitative changes also occur from the use of alimentary substances. An exclusive meat diet sooner or later causes hyperlithuria in man. The urine of carnivorous animals abounds in uric acid. But certain vegetables—such as asparagus, sorrel, and garden rhubarb—cause transitory oxaluria. In directing the diet of invalids, the foregoing facts are worthy of earnest consideration.

Medicinal agents, internally administered, for diseases affecting organs other than the urinary, often act injuriously upon the urine, and thus disturb the urinary function. Among these agents may be mentioned cantharides. Even when applied externally, in the form of blisters, the active principle of cantharides has been known to be absorbed in sufficient quantity to produce dysuria and strangury. Belladonna, used too freely, causes retention of urine. Opium possesses, among its properties, that of causing oliguria, and the diminution of the aqueous element induced by the prolonged and excessive use of this drug sometimes renders the urine irritating to the extent of producing cystitis. Spirits of turpentine, given freely by mouth or rectum, has provoked strangury and hæmaturia. The too free ingestion of copaiba and other balsamics for the cure of urethritis has caused grave disturbance of the urinary function, and even fatal renal disease.

Mental concentration is well known to cause polyuria. Brain workers urinate frequently and abundantly, and their urine is generally of low specific gravity.

A sudden impression upon the nervous system—as from anger, fear, injury, etc.—so increases the blood-pressure upon the kidneys as often to cause a marked increase in the urinary excretion. From certain injuries, particularly those of the head, the urinary excretion is greatly increased, and the attendant shock so paralyzes sensation that retention of the increased urine ensues. The first duty of the surgeon in such a case is to catheterize his patient and relieve the bladder, which would otherwise become inordinately distended in a few hours.

Errors in the nutritive function lead alike to hyperlithuria, oliguria, polyuria, glycosuria, and their consequences. Persistent hyperlithuria leads to or aggravates pre-existing cystitis, urethritis, and urethral stenosis, and is the parent of certain vesical stones. In oliguria, polyuria, and glycosuria the urine possesses irritating properties that will be stated later. Various diseases of other organs—such as the heart, lungs, and liver—react in sundry ways upon the urinary apparatus, disturb its function, and finally damage permanently some of its organs, notably the kidneys. Obstruction to the urinary flow—as from a stricture, injury of, or foreign body in, the urethra, or from enlargement of the prostate—disturbs the function by causing unduly frequent and difficult urination, or even retention of urine.

II.

OUTLINE OF THE GENERAL PATHOLOGY OF THE URINARY APPARATUS.

GENERAL pathology, the foundation of special pathology, indicates the nature and constituent elements of morbid processes, and therefore their names and classes. From its study are deduced general principles for guidance in special pathology. It establishes the technical language and constitutes the chief part of the science of medicine. It has for its basis bio-chemistry, physiology, embryology, and histology. A fair knowledge of each of these branches of biology is indispensable to the right understanding of the processes of disease.

To bio-chemistry and physiology it is not now necessary to do more than allude, but to the cardinal points in the principles of embryology and histology it is proper that a little space be devoted as an introduction to the arrangement of the subjects of future examination.

It is well known that the elementary tissues of the human body are all derived from a primordial ovule, which, originally spherical in form, undergoes segmentation soon after its fecundation. This ovule then undergoes certain changes of form and size by invagination of one of its halves into the other, giving rise to what is called the gastrula. At this period of the life of the blastodermic vesicle, three parts consisting of cells are specialized, to wit: the epiblast, the hypoblast, and the mesoblast. From the epiblast arise the epidermic covering of the body and, it is said, also the brain; from the hypoblast is formed the epithelium of the internal mucous membranes; and from the mesoblast come the blood-cells, the endothelial or connective tissues (comprising mucous, glious, fibrous, cartilaginous, and osseous tissues), muscle tissue, and nerve tissue. Many of the cells, particularly those derived from the mesoblast—notably the blood-cells—are disseminated in the tissues of the body, and play a most important part in the morbid processes, some of them retaining their embryonic character.

The cells which exist in the fully developed human body may be enumerated in accordance with their form as follows: spheroidal, discoid, oval, irregular multinucleated, polygonal, fusiform, unipolar, bipolar, multipolar, cylindrical, and squamous cells. These cells, in a more or less modified state, exist in diseased tissues, or rather, in this altered state, constitute disease of most of these tissues. The morbid processes consist in alterations in the blood, disturbances in the circulatory apparatus, pathengenetic alterations of structure, retrograde metamorphoses, tumors (comprising neoplasmata, adenomata, cystomata, and blastomata), concretions, injuries, the lodgment of foreign bodies, parasitic invasion, monstrosities, and functional disorders.

To be abreast of the advances made toward a better knowledge of these morbid processes, and prior to the consideration of special diseases of particular urinary organs, an introspection of their general pathology will be conducted in accordance with the following division: 1, phlegmasic; 2, stenotic; 3, auxetic; 4, echmatic; 5, ectatic; 6, lithic; 7, neoplasmatic; 8, adenic; 9, blastomatic; 10, cystic; 11, entozoic; 12, toxic; 13, traumatic; 14, allotrylic; 15, teratic; and 16, functional affections of the urinary apparatus.

1. *The term phlegmasic affection* is intended to convey the idea of a morbid process, one of the local nutritional changes which, when visible and tangible, is ordinarily characterized by heat, redness, swelling, and pain, and which is now believed by many pathologists to be generally caused by microbic invasion.

Admitting that microbia generally constitute an important factor in the causation of phlegmasic action clearly implies that they are not invariably the exciting agents in this nutritional change. To what else, then, besides microbia, can phlegmasic action be attributed? It is well known that acute phlegmasic action very frequently becomes chronic or ends in sclerosis and contraction of tissues without suppuration, and that microbia are not found in these abnormal tissues. Further, that in certain deep-seated purulent collections microbia are not always found. Suppurative phlegmasia has been experimentally produced and no microbia found in the pus. Does not the explanation rest in the fact that individual human cells, like individual men, sicken, undergo nutritional alterations, or even starve to death, owing to insufficient pabulum or to its exclusion by the sudden plugging of a neighboring blood-vessel, and are cast away if there be a proper channel for their exit, otherwise they may be devoured by leucocytes or taken up as effete material and excreted? Are not some of the phenomena of amicrobic phlegmasia, such as the occurrence of rigors and febrile reaction, due to the effect of the animal alkaloids that so often result from tissue decay? Bio-chemists assert that one fifth of the normal human body is in a necrotic state and that man exists only by virtue of the metabolic action which is constantly going on in the organism; this death and regeneration of tissue being molecular, gradual, and continuous, and the effete material being eliminated by different apparatuses of the body. From interruption of this elimination and from inability of the human cell to resist the effect of certain infections, of injuries, or of poisons, doubtless arise many of the phlegmasiæ.

Of the several hypotheses respecting phlegmasic processes, the last, based on Cohnheim's illustration of the emigration of leucocytes, offered by Mr. J. Bland Sutton, seems the most rational.

The colorless blood-corpuscles, leucocytes, which are endowed with amœboid properties, constitute the most important of the factors of phlegmasic processes, and how they emerge through stomata in the walls of the capillary blood-vessels has been fully explained and demonstrated by Cohnheim and photographed by Woodward. Pathologists of to-day are disposed to regard phlegmasic processes as conservative, as having a tendency to repair such mischief as may be inflicted by foreign bodies, or by tissues that have died from want of adequate sustenance or from violence. The dead tissues or the foreign substances, be the latter micro-organisms, their ptomaines, or any other extraneous objects, as so well set forth by Mr. Sutton, are at once attacked by migrated leucocytes which strive to ingest and digest the offenders; but it sometimes happens that many of these leucocytes die in the struggle or are so numerous as to crowd themselves and the ambient tissues to death, and form what is called pus, and a slough. If, however, the leucocytes prevail in the struggle, resolution occurs. They undergo fatty degeneration, are absorbed by the lymphatics, and thus disappear, leaving the parts as nearly as can be in their former state. The leucocytes do not always undergo this fatty degeneration, but are sometimes transformed into scar tissue which tends to contract and cause shriveling of the surrounding parts.

In the case of phlegmasia of mucous membranes great numbers of leucocytes make their way from the subepithelial capillaries, and, by virtue of their amœboid properties, reach the surface of the membrane, by passing through stomata between the epithelial cells, to attack and devour foreign invaders, but find themselves in an unhabitable territory, and, like a disorganized mob, are scattered in all directions to perish and be cast away. This accounts for the abundant suppuration in phlegmasia of mucous membranes.

The phenomena of visible and tangible phlegmasia have been explained as follows: The heat is owing to increased tissue oxidation; the redness, to blood stasis; the swelling, to an exudate; and the pain, to mechanical pressure of nerve twigs by the exudate.

Phlegmasiæ are designated superacute when the phenomena of heat, redness, swelling, and pain are intensified in the highest degree; acute, when these phenomena are fully characterized, but of less intensity than in the superacute, both being of comparatively short duration; subacute, when the phenomena are not all apparent or are mild in character; and chronic, when, after the violence of superacute or acute phlegmasia has expended itself, resolution is very slow or indefinite. Though the chronic is ordinarily the continuance, in a mild form, of the superacute, acute, or subacute phlegmasia, it often begins without previous superacute, acute, or subacute phlegmasia, and the morbid process lasts an indefinite time.

Chronic phlegmasia is, therefore, a variation in degree rather than in kind, all the phenomena of the acute types existing, but in a lesser degree. Its designation chronic implies its quality of persistency.

In early times diseases were subdivided into subacute, lasting from twenty-one to forty days; acute, lasting fourteen days; sub-very-acute, lasting seven days; very acute or superacute, lasting two, three, or four days; and chronic, those which are prolonged beyond the fortieth day.

The expressions subacute, acute, and superacute phlegmasia now have reference to the intensity rather than, as formerly, to the duration of the affection.

The evolution of acute phlegmasiæ is characterized by four distinct stages or periods.

The first stage is called the period of incubation—the hatching, as it were, of the phlegmasia—the preparatory stage; it may last a few hours or several days. It begins at the moment of contagion—of the advent of a foreign intruder, or of whatever else may be the irritant, for an irritant is necessary to the development of phlegmasic action.

In the beginning there is an increased afflux of blood to the part irritated. If the irritant is removed, the phlegmasic process is cut short almost at its inception. The word deliquescence may properly be used to express the idea of sudden cessation of phlegmasic action—its melting away. A good example of this is in the case of lodgment of a foreign body under the eyelid. In less than an hour there is congestion of blood in the conjunctival vessels and excessive lacrymation. If the foreign body is at once extracted, this congestion soon decreases and ceases in two or three hours. Another example is the entrance of a pudendal hair into the urethra, causing an almost intolerable itching and a free flow of mucus. Soon after the hair is removed the irritation is relieved and the mucous flow ceases. The penetration of the tissues by foreign bodies, be they organic or inorganic, gives rise to this afflux of blood and congestion necessary to the effusion of serum and the migratory process of the leucocytes. The incubation is then ended, the phlegmasia is hatched, and the second stage begins.

The second stage is called the period of increase. During this period, which lasts from two to six days, the four phenomena are manifested and become more and more intense. It is during this period of increase that the leucocytes are most active. A violent struggle goes on between them and the intruder until the phlegmasia has reached its highest point—its acmé.

The third stage is called the static period—the acmé. During this static period, which may last only a few hours, a day or two, or a week, the contest is decided either by resolution, by gangrene, or by suppuration.

The fourth stage, called the period of decline, lasts much longer than any of the former. The beginning of this stage is the beginning of resolution. The migrated leucocytes are victorious, but doomed to death soon after their victory, for resolution is effected by fatty degeneration of these leucocytes, which in that state are absorbed by the lymphatics. When resolution is incomplete the leucocytes do not all undergo fatty degeneration, but are transformed into scar tissue, or, there being still a source of irritation, newly migrated leucocytes reach the surface, die, and are discharged as pus, particularly in phlegmasia of mucous membranes.

When leucocytes have undergone fatty degeneration they sometimes are not absorbed, but undergo caseation and afterward calcareous infiltration, and even when they are organized into scar tissue this also occasionally undergoes calcareous infiltration. The calcareous mass is then encysted and thereby rendered innocuous. This calcareous infiltration, often erroneously called ossific transformation, occurs in the cavernous bodies of the penis, in the vaginal tunic of the testicle, and in other parts of the body.

When gangrene occurs, newly migrated leucocytes attack the dead part and tend to loosen it from the living tissues until it is cast away.

Phlegmasiæ of the urinary organs are engendered by general dyscrasiæ, by parasitic invasion (vegetable and animal), by other local irritants, by injuries, or by contagion, and in their turn engender local affections, such as stenoses, auxeses, echmases, ectases, etc., as well as functional disorders.

2. *A stenosis* is a contraction. This term is applied to contraction of hollow viscera or of ducts. Stenotic affections proceed generally from phlegmasic action, and are pathic conditions of hollow viscera and of excretory ducts, as in the cases of the permanently contracted bladder with diminution of its capacity, and of stenosis or stricture of the ureters and of the urethra. A stenotic affection may or may not be obstructive. Stenotic affections are sometimes congenital, sometimes traumatic, but are most frequently the offsprings of pre-existing morbid conditions, as, for instance, the stenosis of the bladder which springs from phlegmasia of that viscus, or the stenosis of the urethra resulting from urethritis.

In stenosis of the bladder there is not only permanent contracture of the muscular layers, but sclerosis of the submucous connective tissue. In many cases there is augmentation of the muscular element, and consequently general thickening of the walls of the viscus. This condition may be properly classed with that of diffuse myomata.

In idiopathic stenosis of the urethra there is not a mass of inodular tissue, as was formerly supposed, but a layer of scar tissue of extreme tenuity, this scar tissue resulting from a local slow retrograde metamorphosis, a condition of sclerosis, tending to progressive contraction of the imperfectly organized plasma of circumscribed acute or of chronic urethral phlegmasia. This imperfect organization is, in part, owing to the obstruction of blood and lymph capillaries by the mechanical compression exerted by the leucocytes of the plasma. The sclerosis may involve the mucous membrane, the submucous connective tissue, the spongy substance, or all three layers. In traumatic stenosis a similar condition exists, but is developed with much greater rapidity, the scar tissue contracting as quickly as that resulting from burns. In idiopathic as well as in traumatic urethral stenosis, therefore, it may be confidently asserted that there is nothing to be absorbed, but rather that there is need of regeneration of tissue, and to promote such regeneration the surgeon makes an artificial gap in the urethra by divulsion, or by incision of the constricted part, which Nature fills and thus splices with new cicatricial tissue.

3. *An auxesis* is an enlargement. Auxetic affections of the urinary organs are states of enlargement which generally interfere, in varying degrees, with the uses of these organs, and are the outcome of phlegmasic, echmatic, neoplasmatic, adenic, cystic, or traumatic affections. However, auxetic action is sometimes beneficent, occurring when one of a pair of organs is destroyed, as in the case of loss of one kidney, the remaining kidney undergoing compensatory auxesis sufficient to enable it to excrete more than when its fellow was sound. Here nephrauxe is the reverse of a pathic condition. Prostatauxe, on the contrary, arises from pathic states of the prostate itself, and is often the cause of grave disturbance in urination.

4. *An echmasis* is an obstruction. Echmatic affections

of the urinary apparatus are states of obstruction of excretory ducts arising from acute phlegmasic swelling, from stenoses, from neoplasmata, or from impaction of uroliths or of foreign bodies. Acute prostatitis causes echmasis of the urethra and urethro-vesical orifice, and, consequently, retention of urine. Narrow urethral stenoses give rise to sufficient echmasis of the urethra to cause its dilatation behind the seat of disease. Neoplasmata of the prostate, with unequal enlargement of its lobes, cause urethral or urethro-vesical echmasis. Impaction of uroliths in the ureter causes echmasis of this excretory duct and consequent retention of urine, inflammation, and ectasis of the renal pelvis. Foreign bodies in the urethra cause echmasis and retention of urine. Long-continued echmasis, even when incomplete, causes permanent ectasis and chronic inflammation behind the point of obstruction, and, in many cases, destruction of the upper urinary organs and death.

5. *An ectasis* is an expansion. This term is applied to expansion of hollow viscera and of canals. Ectatic affections are conditions of expansion, of dilatation, of hollow viscera, of excretory ducts, of lymphatic and blood vessels, or of serous cavities. Ectatic affections are due to phlegmasic action, or to echmasis from disease, injury, or the lodgment of foreign bodies. Morbid dilatation of the bladder, local or general, belongs to the order of ectatic affections. Ectasia of the renal pelves is often caused by hydronephrosis and pyonephrosis. The accumulation of serum in the tunica vaginalis testis causes ectasia of this vaginal tunic.

6. *Lithic affections* are produced by the formation of concretions, varying greatly in density, form, and size, in crypts, ducts, or cavities of the human body. Those now under consideration are the uroliths and prostatoliths.

Uroliths are concretions formed from the salts of the urine around nuclei which, from their irritating contact, excite a copious flow of tenacious mucus, serving as a cement to the crystalline or to the amorphous salts of which they are composed. Prostatoliths are concretions originating in the crypts of the prostate.

Lithic affections of the urinary organs should be studied under the following heads: Those caused by uroliths of diathetic origin, those caused by uroliths of accidental origin, and those caused by prostatoliths.

The uroliths of diathetic origin are due to hyperlithuria, caused by disturbances in the nutritive function.

The uroliths of accidental origin are due to stagnation of urine, to tumors of the bladder, to injuries, or to the presence of foreign bodies.

Prostatoliths are due to the death of sympexia, which exist normally in the prostatic crypts, and to their gradual increase in size by phosphatic incrustation.

7. *Neoplasmata* are tumors formed by cell proliferation. Neoplasmatic affections of the urinary organs comprise epithelial neoplasmata, endothelial neoplasmata, myoneoplasmata, and angeioneoplasmata.

The epithelial neoplasmata are the polymorpho-cellular, the cylindro-cellular, and the squamo-cellular. The first two, derived from the epiblast and hypoblast, contain fibrous tissue and are malignant. The third species contains no fibrous tissue, but is also malignant. The lower the grade of structure, the greater the malignity. These species have their varieties and subvarieties, the presence of more or less fibrous tissue constituting the variations in the first two species, as ino-epithelioma (medullary cancer) and hyperino-epithelioma (scirrhous cancer). The subvarieties are the papillary and the teleangeiectatic (fungous hæmatodes). The third species, squamo-cellular (epithelioma), derived from the epiblast, has two varieties, myxoid and keratoid ; and one subvariety, papillary.

The idea that epitheliomata are provoked by microbic invasion has been enunciated by several bacteriologists, and a few years ago a German bacteriologist announced the discovery of a cancer bacillus, but other bacteriologists have so far failed to find a specific organism in cancer.

"The term cancer," says Mr. Sutton, "in the present day is restricted to tumors resembling formed glands. . . . Cancers are aberrant glandular formations, and may not inaptly be defined as biological weeds. . . . The glandular nature of cancers is further illustrated by the fact that in their intimate structure they resemble the glands in the immediate neighborhood. Thus, a cancer of the lip resembles the cutaneous glands; in the liver it mimics the liver; mammary cancer resembles imperfectly the secreting tissue of the breast, and so forth. Cancers are downward growths of epithelium into the subjacent tissues."

Endothelial neoplasmata, which are among the mesoblastic new growths, are ranked with desmoneoplasmata, from their elements being embryonic states of the different forms of connective tissue.

The endothelial neoplasmata of the urinary organs are endothelioma, inoma, and myxoma.

The genus endothelioma (sarcoma or endothelial cancer) has four species, the globo-cellular, the fuso-cellular, the giganto-cellular, and the plano-cellular (flat-celled sarcoma or endothelioma). Only the first three occur in the urinary organs. The globo-cellular, small and large celled (round-celled sarcoma), has five varieties, only two of which occur in the urinary organs—ino-endothelioma (round-celled fibro-sarcoma), and myxo-endothelioma (round-celled myxo-sarcoma); and two subvarieties—papillary and teleangeiectatic. The fuso-cellular, small and large celled (spindle-celled sarcoma), has the same varieties and subvarieties as the first species. The giganto-cellular (giant-celled sarcoma) has the same varieties and subvarieties as the first and second species.

Mr. Sutton places the sarcomata among infective tumors caused by micro-organisms, and says: "Those tumors which pathologists term sarcomata differ from those produced by the ray fungus in the following particulars: The micro-organism or causative agent has not yet been isolated, and we have no satisfactory evidence that a sarcoma can be inoculated into another animal. Nevertheless, the two forms of tumors agree in the general principle of structure, disastrous effects upon the life of the individual, and in a tendency to infect the system. Careful research wil probably establish before very long a poison or micro-organism for each of the various types of sarcoma." He is inclined to believe that these tumors are the products of phlegmasic action, due to microbic invasion, and further says: "To put the matter in a clear form, a sarcoma is probably the scene of action of a violent and prolonged conflict between irritant micro-organisms and leucocytes. I say probably, because, as has been already remarked, bacteriologists have not yet succeeded in isolating a special bacterium for sarcomata in general; that such agents will soon be discovered is in the highest degree probable, because in recent years each increase in the list of infective granulomata is made at the expense of sarcomata. The structure, mode of growth, infective properties, and manner in which these tumors destroy life clearly coincide with what is positively known with regard to infective granulomata. The fact that sarcomata make up the greater part of tumors occurring in wild and domesticated animals has, in my opinion, a very significant import in this relation."

Assuming these views of Mr. Sutton to be correct, they do not necessarily affect the classification just given of sarcomata, which remain endothelial growths, whatever may be their cause.

The genus inoma (benign) has two subgenera—circumscribed inoma and diffuse inoma. These two subgenera have two species—the plano-cellular and the fasciculated. Each species has five varieties, of which the first and second occur in the urinary organs—viz.: endothelio-inoma (malignant) and myxo-inoma (benign), the subvarieties being the papillary and teleangeiectatic.

The genus myxoma has two species—the monomorpho-cellular and the polymorpho-cellular. The two species have three varieties—endothelio-myxoma (malignant), ino-myxoma and lipo-myxoma (both benign), and two subvarieties—the papillary and teleangeiectatic.

A myoneoplasma is a new growth of muscular fibers, and therefore of mesoblastic origin.

The order myoneoplasmata has one genus, myoma; two subgenera, circumscribed myoma, diffuse myoma; and two species, rhabdomyoma, leiomyoma (all benign), each species having two varieties, inorrhabdomyoma or inoleiomyoma, circumscribed or diffuse, as the case may be, and endothe-iorrhabdomyoma or endothelioleiomyoma, generally called myosarcoma (malignant).

If Mr. Sutton's interpretation of the nature of sarcomata is correct, then, when the sarcomatous element constitutes subvarieties of neoplasmata, these previously benign neoplasmata are rendered malignant by the invasion of micro-organisms which are combated by migrated leucocytes.

Angeioneoplasmata are tumors made up of blood or lymph vessels, and are of mesoblastic derivation.

The order angeioneoplasmata has one genus, angeioma; two species, hæmatangeioma and lymphangeioma; and two varieties, cirsoid and cavernous (all benign).

8. *The adenomata* constitute a class of tumors having the same structure as the glands in which they occur. This structure is, however, imperfectly elaborated, is characterized by epithelial hyperplasia, and tends to metamorphosis into malignant epithelioma, which occurs as soon as the cells

have broken the barrier opposed to them by the limiting membrane of the acini.

This class has two orders, ectocœliac and entocœliac adenomata. The first order has four and the second order six genera, each generic name indicating the gland affected. Only three of the entocœliac adenomata occur in connection with the urinary apparatus: lymphadenoma (adenoma of a lymphatic gland), nephradenoma (adenoma of the kidney), and myxadenoma (adenoma of mucous glands).

Mr. Sutton, who recognizes the existence of adenomata in the sense in which the term is used above, admits their liability to be transformed into cancers. The following are his comments on the subject:

"In young individuals we find occasionally in connection with a functional gland a tumor which, when examined microscopically, displays all the features peculiar to the gland with which it was connected; the only point in which it differs is that the adventitious mass is impotent—that is, it can not produce the secretion peculiar to the gland from which it arose. Such a tumor is called an adenoma, and receives a specific name according to the gland it resembles—sebaceous, mammary, renal, hepatic, etc. Adenomata may attain enormous size and weigh many pounds. As life advances the mimicry is crude; the cells, instead of clothing the alveoli in a regular manner, are tumbled together in confusion. Such tumors are cancers; they grow aimlessly, having no function to keep them in subjection, and, being poorly supplied with blood-vessels, undergo degenerative changes, and the cells, being dispersed over the body, may reproduce, in remote tissues and organs, secondary tumors resembling the original cancer from which they arose."

9. *Blastomata* are infective granulation growths invaded by micro-organisms.

The blastomata that affect the urinary organs are the syphilitic, syphiloid, and tuberculous.

Syphilis is a toxæmia caused by a virus deposited upon an abraded cutaneous or mucous surface and absorbed into the organism; it is therefore a general dyscrasia. It is due to immediate as well as to mediate contagion, and the nature of its virus is still an unsettled question. By some investigators it is regarded as a microbic affection. If this view is correct, a ptomaine of syphilis will be the next discovery.

The initial lesion of syphilis is at the seat of inoculation and appears as a sclerosed spot called chancre.

Syphilis is often transmitted from parent to offspring, and in that case is generally designated as hereditary.

Lustgarten thinks he has discovered a bacillus peculiar to syphilis, and the same view is taken by Doutrelepont, but other investigators do not confirm this view. However, there is no doubt of the presence of sundry micro-organisms in syphilis as in the other blastomata, whose granulation tissue affords them abundant sustenance, for the microbia are known to thrive in structures of low vitality. In unclean subjects, saprophytic organisms swarm in chancres and other kindred lesions.

Syphiloid (chancroid or soft chancre) is contagious, but does not infect the whole system, as syphilis does. The nature of the contagium of syphiloid is unknown. Syphiloid ulcers are infested with saprophytic micro-organisms which in themselves are not poisonous. Syphiloid is contagious, both mediately and immediately, but without the long period of incubation, such as occurs in syphilis, the lesion showing itself within forty-eight hours after contact with denuded skin or mucous membrane.

Tuberculosis is now believed to be due to infection by a micro-organism named, in 1882, by Koch, the tubercle bacillus. This microzyme is supposed to enter the human organism through the respiratory, the digestive, the genital, or the urinary organs, as well as through abrasions or wounds of external parts, the most common inlet being the respiratory apparatus. By modern pathologists tuberculosis is regarded as a phlegmasic process, which they explain as follows: As soon as the tubercle bacilli effect lodgment in the tissues their irritating presence causes, in the ambient capillaries, an increased afflux of blood. These capillaries are thereby dilated, and the stomata at the junction of endothelial cells allow the leucocytes, by a temporary alteration of form, to effect their exit. Thus begin their migration and their warfare with the bacilli which they ingest and digest. If victorious, the conflict is ended and resolution occurs. If the leucocytes are not able to cope with a large aggregation of bacilli, they sometimes operate its encystment by their own conversion into scar tissue. If the bacilli are too numerous, the leucocytes perish and suppuration ensues. The infection then becomes general and the sufferer succumbs. The presence of giant cells in tubercles is explained by the coalescence of numbers of leucocytes.

10. *Cysts* are inclosed spaces whose contents, fluid or solid, are circumscribed by fibrous tissue, or some other more or less complex structure, with or without a lining of epithelium, according to their genesis. There are five orders of cysts—epithelial, endothelial, degeneration, parasitic, and teratic cysts, among which are the dermoid.

The epithelial cysts occur in crypts or ducts lined with epithelium, and are due to the occlusion of a duct, and consequent retention and accumulation of glandular secretion. Epithelial cysts contain more or less cast-off epithelium, sometimes plates of cholesterin, and the fluid and the solids of the particular secretion, and accidentally blood. Their variations of size are extreme.

The endothelial are exudation cysts formed in connective-tissue spaces, in false membranes, and in obstructed lymphatics. Their contents are ordinarily lymph, and accidentally blood is superadded. They are often called hygromata.

The degeneration cysts result from a necrotic process in the substance of organs, and often of neoplasmata, and their contents are the products of disintegration of the structure of the organ or neoplasma. Some degeneration cysts have fibroid walls, resulting from the conversion of surrounding leucocytes into scar tissue for the protection of adjacent parts. The encystment of tubercular nodules, of foreign bodies—such as bullets, fragments of glass or pottery, of needles, etc.—of clots of blood, of cheesy nodules, etc., is effected in this manner to render them innocuous. Parasites, and certain monstrosities, in like manner and for the same purpose, undergo encystment.

11. *Entozoic parasites* are animals living within and at the expense of the body.

The entozoic parasites that invade the urinary organs are the *Echinococcus hominis*, the *Distoma hæmatobium*, the *Pentastoma denticulatum*, and the *Strongylus gigas*. *Filaria sanguinis* and *Trichina spiralis* have been found in the urine.

These entozoa reach the human organism principally through food or water polluted by animals that are infested with these parasites.

Worms, such as lumbrici, or joints of tænia, have passed from the intestine into the bladder and have been found in the urine. They should not be ranked as parasites of the urinary organs, since they enter the bladder through fistulous tracts. In young female subjects, pin-worms, infesting the rectum, have been known to make their way to the vulva, and finally to creep into the bladder through the urethra. In both cases these are designated as erratic worms.

Larvæ of flies, introduced into the bladder, accidentally and sometimes designedly, have been mistaken for parasites. These are classed as spurious worms. The *Spiroptera hominis*, *Diplosoma crenatum*, and *Dactylius aculeatus* are among the spurious worms.

12. *Poisons* are substances, either organic or inorganic, which, when introduced into the system by the cutaneous, respiratory, or digestive apparatus, are capable of producing disease or death.

Some poisons are very irritating to the urinary tract, and even cause structural disease.

Many of the medicinal drugs, when taken in large doses or when used for a long time, act noxiously upon the urinary organs, particularly those that are freely eliminated by the kidneys.

Besides the ptomainic poisons derived from bacterial action, there are other virulent poisons to which the name of leucomaines has been given and which originate in the animal economy from tissue disintegration without the agency of bacteria. These leucomainic poisons cause diseases which have been named autogenous, and the nature and course of which are daily becoming better known and interpreted, thanks to the labors of the bio-chemists.

13. *Traumatic affections* are hurts caused by violence. But the use of this term is generally extended to designate structural violence inflicted otherwise than by a wound. The injury may be effected directly or indirectly by the fracture of a bone, by contusion, puncture, perforation, incision, laceration, crunching, cauterization, or congelation.

14. *Allotrylic affections* are morbid states caused by the lodgment of foreign substances in the organism. The foreign substances may be animate or inanimate, organic or inorganic.

A foreign substance may enter the urinary tract by the natural route, or by an artificial route resulting from disease or from violence.

15. *Teratic affections* are congenital or acquired deviations from the essential characteristics of organized beings.

dered by (1) perversion, (2) deficiency, (3) suspension, (4) excess, (5) diminution, (6) abolition.

1. *Perversion* of function is exemplified by glycosuria, albuminuria, peptonuria, chyluria, lipuria, hæmoglobinuria, hæmaturia, pyuria, pneumaturia.

2. *Deficiency* of function is exemplified by dysuresis (difficult urination), ascheturesis (irrepressible urination), aconuresis (involuntary urination).

3. *Suspension* of function is exemplified by ischuria, the consequences of which are often ectasia of the ureters, bladder, or urethra ; cystitis ; rupture of the urethra and extravasation of urine ; urinary fistulæ ; or rupture of the bladder.

4. *Excess* of function is exemplified by hyperlithuria, polyuria, sychnuresis (frequent urination).

5. *Diminution* of function is exemplified by oliguria.

6. *Abolition* of function is exemplified by anuria.

III.

SUMMARY OF THE ÆTIOLOGY, SEMEIOLOGY, DIAGNOSIS, PROGNOSIS, PROPHYLAXIS, AND GENERAL THERAPEUTICS OF DISEASES OF THE URINARY APPARATUS.

THE results of an examination of the morbid processes of the urinary apparatus having been stated as a preliminary step to the study of special affections of particular organs, further inquiry into general principles is necessary to the elucidation of the ætiology, semeiology, diagnosis, prognosis, prophylaxis, and therapeutics of these affections. This study presupposes a fair knowledge of anatomy, physiology, and pathology; otherwise the labor would be vain.

THE CAUSES of diseases of the urinary apparatus are intrinsic and extrinsic.

Examples of intrinsic causes are disorders of the nutritive apparatus, the gouty diathesis, malformations, etc.

Examples of extrinsic causes are contagion, parasitic invasion, injuries, the lodgment of foreign bodies, and poisons.

The so-called predisposing causes may be intrinsic or extrinsic. Among these causes are pre-existing diseases of organs other than the urinary, such as the lungs, the heart, or the liver, intemperance, filthy habits, etc. Predisposition is now better understood by the broad term vulnerability. For example, any disease of an organ which causes passive congestion in another organ renders this organ vulnerable, that is to say, more easily invaded by structural disease. Intemperance in strong drink leads to diseases of the liver as well as of the urinary apparatus. The drunkard, already made vulnerable by the poison alcohol, is often so much exposed to the severity of the weather that his urinary apparatus is thereby made more susceptible to disease. He is apt to be careless in his personal habits and to leave his external genital organs in an unwashed and filthy state, which renders them particularly vulnerable. The same individual may be more vulnerable at certain times than at others, and many circumstances may arise to increase this vulnerability, such as a transitory disorder of any of the functions. He is likely to be less vulnerable when his bodily functions are normal.

Diseases of the urinary apparatus may arise primarily, as, for instance, a phlegmasia, a neoplasma, a blastoma, a parasitic invasion, etc.; may be consecutive to a general dyscrasia, or to disease of an organ of the same or of another apparatus, as in the case of a stenosis, an ectasis, a concretion, a cyst, a functional disturbance, etc.; may be the outcome of injury or may be a disorder of the function of the apparatus from parasitic invasion, from an injury, from a teratism, or from a poison.

THE SYMPTOMS of disease of the urinary apparatus are subjective and objective. The varieties of subjective symptoms perceived are proportionate to the degree of sensitiveness, intelligence, and power of observation of patients.

Young children perceive pain only, and give it expression by an outcry. Stolid, stupid, ignorant, degraded men are ordinarily little sensitive to pain, and unable to give a satisfactory account of their condition. Pusillanimous adolescents are unduly demonstrative of pain, even when it is slight, while courageous, plucky youths when in great suffering make little or no complaint, but the facial expression betrays their distress. There are neurotic, hysteroidal adults who suffer more from apprehension of pain than from the pain that exists, or that may be inflicted during a physical exploration. The management of these algophobists is tedious, difficult, harassing, and requires tact, patience, forbearance, delicacy, and gentleness; but, above all, it is necessary that the patient have the greatest confidence in the ability and integrity of the physician. Once convinced that he is not to be injured, he becomes docile and submits to treatment with no further anxiety. In some cases a tumefaction, if not painful or tender, is unnoticed by the patient for a long time. Emaciation, however, seldom escapes the patient's attention. Hæmaturia, pyuria, dysuresis, aconuresis, ischuria, hyperlithuria, sychnuresis, polyuria, and oliguria, though functional disorders, rank also as symptoms which are perceivable by the patient. Symptoms are often so inaccurately detailed by patients that the physician is obliged to subject them to the most rigid cross-examination in order to obtain trustworthy information.

Objective symptoms are perceived by the physician from answers to well-directed questions, from ocular and manual inspection, and from examination of excretions.

A symptom denoting invariably the existence of a particular disease becomes a sign. Such symptoms are few, and are called pathognomonic. It should be remembered that the symptom belongs to the senses and the sign to the understanding. The patient perceives certain symptoms, but the physician alone can interpret them and detect a sign. The diagnostic symptom, that manifestation which occurs more frequently in connection with a particular disease than with other diseases, is appreciable only by the physician.

Prior to the analysis of symptoms, close inquiry should be made into the history of the patient and the history of his disease. His constitutional peculiarities, inheritance of disease, previous diseases, occupation, age, and habits, and the possible existence of organic disease other than urinary, should form the basis of the inquiry into the history of the patient.

The history of the disease for which the patient invokes assistance is the next step in the inquiry. The date of prodromic symptoms and of other manifestations is noted, and the history of the disease traced down to the present. Then questions are asked relating (*a*) to the seat, character, degree, and duration of pain, (*b*) to disordered urination, (*c*) to the amount of urine passed each day, and (*d*) to the general characters of the urine.

(*a*) PAIN occurs in nearly all the affections of the urinary organs. It is often the first symptom perceived, and it is ordinarily for its relief that the patient seeks advice. Therefore the physician should be precise in ascertaining the time and circumstances of its inception, and in learning its seat and character; whether it is intermittent or continuous, dull or acute, aggravated or not by exercise, intensified or not in the night; whether it occurs before, during, or after urination, or is independent of urination. *Pain deeply seated* in the lumbar region may be dull or acute.

Dull pain in this region indicates a lesion of slow development—as, for example, hydronephrosis or pyonephrosis, chronic pyelo-nephritis, chronic retention of urine in the bladder, etc.

Acute pain is felt in the lumbar region and vicinity, and also along the course of the ureter, during the migration of a urolith or from any cause of sudden obstruction to the flow of urine from the kidney to the bladder. The pain is often radiated to the other abdominal viscera, and is so intense as to require the free use of anodyne medicines.

Persistent dull pain in the hypogastric region may be owing to stagnation of urine in the bladder, or to chronic cystitis due to the presence of a tumor, or to some other cause.

Acute pain in the hypogastric region is evidence of rapid distention of the bladder by the urine, or of irritation caused by the presence of a urolith or of a foreign body, especially in the bladders of young subjects.

Pain at the extremity of the penis occurs in acute trachelocystitis, in prostatitis, and from the friction of a urolith against the vesical trigone, particularly during sudden movements of the sufferer.

Pain in the sciatic region, often extending to the heel, commonly the left, or along the anterior crural nerves, is suggestive of cystitis, of calculus, of prostatic obstruction or of urethral stenosis, as well as of coincident rectal irritation, these several lesions giving rise also to many other distant neuroses.

(*b*) DISORDERED URINATION merits the close attention of the diagnostician, for it covers a wide and important field of inquiry.

Urination may be (1) frequent, (2) irrepressible, (3) difficult, (4) painful, (5) involuntary, or (6) impossible. (7) The mode of urination also needs to be observed. The jet may be irregular, small, feeble, interrupted, or absent. In the last case the urine may be passed *guttatim*, may slobber involuntarily, or may cease to flow.

1. *Frequent urination* (sychnuresis) is common to nearly all affections of the urinary apparatus of man at one stage or another of their development. It may be asked, What is to be understood by frequent urination? The answer is that no absolute rule can be laid as to what precise number of acts of urination per day should constitute undue frequency. In the same healthy individual the frequency of urination varies according to the season of the year, the character and amount of his food and drink, and of exercise; in fact, all deviations from his habits have their influence upon the quality and quantity of urine secreted, and consequently upon the frequency of its expulsion. There are adults who urinate ordinarily only twice or thrice daily. In these cases five or six acts of urination would constitute undue frequency. There are other adults in excellent health who urinate eight or nine times per day.

In these, twelve or fifteen acts would constitute unduly frequent urination. Certain animals in a state of health—dogs, for instance—often urinate five or six times in the course of half an hour, though they often repress the act for several hours. Some other animals habitually hold their urine eight or ten hours.

Urination is unduly frequent in cases of supersecretion (polyuria), and this frequency accords with the quantity of urine secreted. But undue frequency of urination occurs in many cases where the quantity secreted is even below the normal standard; in such circumstances the undue frequency may be owing to the irritating properties of the urine, to trachelocystitis, or to acute or chronic cystitis, with diminished capacity of the bladder. Dyspeptic and neurotic subjects free from any lesion of the urinary organs urinate with undue frequency by day and by night. "Brain-workers" urinate with undue frequency, and at each act expel a considerable quantity of urine.

Nocturnal sychnuresis is worthy of special consideration. An apparently healthy elderly man may urinate once or twice during the first three hours of the night, but if after this the desire to urinate recurs two, three, or four times, there is good ground for suspecting prostatic obstruction. If, then, in the morning, immediately after urination, a catheter be introduced, from three to eight ounces will be drawn, showing the sychnuresis to be due to cystitis from stagnation of urine. Nocturnal sychnuresis, however, occurs often in calculous subjects free from prostatic obstruction.

Diurnal sychnuresis occurs alike in cases of prostatic obstruction, vesical tuberculosis, tumors, stones, and lesions of nervous centers.

2. *Irrepressible urination* (ascheturesis), often confounded with incontinence of urine, occurs in cases of trachelocystitis accompanied with frequent micturition. It differs from involuntary urination in one essential particular, *i. e.*, the urine escapes, not without, but contrary to, volition, in spite of a strong effort of the will to retain it. In the case of involuntary urination the will is not exercised; no effort is made to repress the urinary flow. When the bladder contracts spasmodically to expel only a small quantity of urine, as in trachelocystitis, whether provoked by a stone or otherwise, all effort on the part of the patient fails to restrain the flow and he soils his garments, or, when this urgent need to urinate awakens him from sleep, he wets his bed before he can reach the urinal. Irrepressible urination occurs occasionally in elderly men with beginning prostatic obstruction. In these cases it is caused by trachelocystitis. The complication of polyuria with cystitis is likewise a cause of irrepressible urination. It also occurs during catheterism of neurotic patients and of young men suffering from trachelocystitis, the urine escaping, notwithstanding the strongest wish to repress it, as soon as the instrument reaches the perineal region of the urethra.

3. *Difficult urination* (dysuresis) is a common symptom of disease of the urinary tract. Although it is ordinarily an indication of material obstacle, such as urethral stenosis,

contracture of the vesical neck, prostatic obstruction, impacted calculous matter, or the presence of a foreign body, it may be owing to other causes, such as lesions of nervous centers, trachelocystitis, diminished or impeded vesical contraction, local congestion, etc. The act of micturition may therefore be slow, may be delayed, or difficult at the beginning, at the end, or throughout.

Slow urination occurs alike in cases of prostatic obstruction, urethral stenosis, and impeded vesical contraction from connective-tissue sclerosis, and may therefore indicate the presence of either or of all these pathic conditions, or may be owing to general neurosis, independent of any local change in the urinary apparatus. Slow micturition occurs also in case of overdistention of the healthy bladder from mere neglect to empty the viscus at the proper time—as, for example, during alcoholic intoxication.

In delayed urination—detention in the expulsion of the first drops of urine—the patient is obliged to wait one or even two minutes before the urine begins to flow. The jet, often feeble and small, is interrupted at short intervals, the patient, in the course of perhaps half an hour, making several walking excursions in his room before the bladder is emptied. This occurs during the morning toilet, and indicates, in young and middle-aged men, urethral stenosis with congestive swelling and spasm of the neck of the bladder, and in elderly men may be a symptom of beginning prostatic obstruction. In many cases, however, free from urethral, prostatic, or vesical disease, it is due solely to congestive swelling at the urethro-vesical orifice incident to several hours of recumbency and sleep, and intensified by distention of the bladder. After free exercise during the day, local congestion ceasing, this retardation of urination is no longer experienced. But when it recurs persistently in elderly men, there is every reason to suspect beginning prostatic obstruction. Delayed urination occurs often in young subjects when the bladder is much distended. Neurotic patients are very subject to this delay. Many individuals are not able for several minutes, or are never able, to urinate in the presence of another person even if he be a physician anxious to witness the act of urination for diagnostic purposes.

Difficult urination, when constant at the beginning of the act, is commonly due to urethro-vesical contracture or to prostatic obstruction, and generally lasts throughout the act, but is not necessarily painful. Toward the end of the act of urination the difficulty is usually owing to the proximity of a urolith to the urethro-vesical orifice; in such a case there is much pain and a scalding sensation in the whole urethral canal. In case of a urethral stenosis the difficulty is proportionate not so much to the degree of the contraction as to its longitudinal extent and tortuosity.

4. *Painful urination* (algeinuresis) is another symptom of most of the affections of the urinary apparatus. It is often an early, and for some time the only, subjective symptom of grave renal disease—tuberculosis, pyonephrosis, calculous pyelitis, etc.—the patient seeking relief of the symptom and not of the disease to which it is due. Any disease

which causes marked alterations in the constituents of the urine renders that urine irritating and otherwise obnoxious to the bladder and to the urethra; in other words, causes, in the bladder and urethra, more or less pain during its emission. Hyperlithuria, excessive pyuria, inordinate alkalinity of the urine, cause much burning pain in healthy urethræ during the act of urination.

5. *Involuntary urination* (aconuresis) most frequently indicates overdistention of the bladder, particularly in elderly men with prostatic obstruction; but it occurs also in cases of overdistention of the bladder, at any age, from urethral obstruction by a stenosis or by the lodgment of a urolith. Involuntary urination is likewise an indication of imperfect closure of the urethro-vesical orifice in elderly men affected with multiple tumors at the base of the prostate; these are among the cases styled true incontinence of urine. Other examples of true incontinence of urine are those due to absolute paralysis of the bladder or to malformations.

The nocturnal involuntary micturition of children is not ordinarily incontinence of urine, for the great quantity passed each time indicates distention of the bladder. The diurnal sychnuresis and involuntary urination of these little ones give evidence of polyuria which is the exciting cause. In some cases there is irrepressible rather than involuntary urination. In none of these cases is there incontinence of urine, for the bladder can and does contain a considerable quantity of urine before the need comes for its expulsion.

6. *Impossible urination*—retention of urine (ischuria)—is ordinarily the outcome of a material obstacle at the urethro-vesical orifice or in the urethra. In the first case, from spasmodic or from permanent contracture, from prostatic obstruction, or from the impaction of a urolith. In the second case, from stenosis, from the impaction of a urolith or of an extraneous body, or from an injury.

7. *The manner in which they urinate* can ordinarily be described by intelligent patients, but, as a general rule, it is better that the physician trust to his own senses in order that he may properly value and interpret the character of urination in particular cases.

The propulsion of the urine is subject to several modifications, in accordance with certain local conditions of the urethra, prostate, and bladder.

Gradual diminution in size of the stream of urine during a period of months or years points to the existence of urethral stenosis.

An inordinately small stream of urine may indicate urethro-vesical contracture, urethral stenosis, or impaction of calculous matter in the urethra.

The passage of urine *guttatim* portends retention of urine from urethral stenosis.

A small, slow, feeble, perpendicular stream, interrupted by a succession of drops, is indicative of prostatic obstruction.

The slobbering of urine is a sign of overflow, and consequently of incomplete retention of urine with overdistention of the bladder.

Constant flow of urine from an undistended bladder is a sign of incontinence of urine.

Small, frequent, spasmodic jets of urine suggest acute trachelocystitis.

(*c*) Inquiry as to the amount of urine passed each day is of no little importance, for very considerable variations occur in primary as well as in secondary renal affections. Thus, for instance, a persistent excess above the amount of urine voided each day may indicate chronic interstitial nephritis with sclerosis (contracted kidney), which may be the outcome of modifications of arterial tension from cardiac disease, or may indicate degeneration of the kidneys from urethral and vesical disease. The increase of secretion (polyuria) varies from sixty to two hundred ounces daily, or even to a greater extent. Polyuria may be complicated with glycosuria dependent upon errors in the nutritive function or upon cerebral disease.

Diminution of secretion (oliguria) may follow polyuria, or may result from acute nephritis. When it occurs during or after an attack of urinary fever it is ominous and portends anuria and death.

(*d*) The physical characters and chemical properties of abnormal urine form the last part of the inquiry into the history of the disease, and comprise an examination of the significance of variations in the limpidity, turbidity, microscopical appearance, color, and chemical reactions of this urine.

Urine may be limpid when voided, it may retain its limpidity after cooling, or may become turbid in a greater or less degree. After standing a short time, limpid urine often yields a reddish deposit resembling ground Cayenne pepper, which, on microscopical examination, proves to be uric acid. When clear urine becomes turbid on cooling and is cleared by the application of heat, and, when it is again cooled, a precipitate once more occurs, it is owing to the presence of urates which may be identified by microscopical examination. Clear urine sometimes yields a scanty deposit consisting of oxalate of lime or of casts of the uriniferous tubes, free epithelium, etc., indicating in the second case renal disease.

The urine may be markedly turbid, resembling pea-soup, when passed. This is owing to the presence of a great amount of urates. A very abundant purulent sediment indicates cystitis, pyelitis, or both. When this sediment consists of creamy pus the presumption is that the pus comes from the pelvis of the kidney, but when the pus is slimy and contains phosphatic crystals, it is presumably vesical.

The color of the urine should be carefully noted for diagnostic purposes, and its significance will be fully realized by studying the accompanying table, illustrative of the tints of urine, copied from Thudicum's excellent work on the pathology of the urine :

Table Illustrative of the Tints of Urine (Thudicum).

Color.	Substance to which the color is due.	Shortest chemical test.	Concomitant characters of urine.	Pathological indications.
Pale yellow hue to straw-yellow.	Uræmatin, smallest amount.	....	Reaction mostly neutral. Little urea and solids (except diabetes, when sugar augments solids).	Much water drunk. Anæmia, chlorosis, diabetes. Excludes febrile and acute diseases.
Lemon-yellow.	Uroxanthin.	Drop twenty to forty drops of urine into two or three drachms of fuming hydrochloric acid. Reddish violet color to blue is produced.	Deficiency of uræmatin.	Occurs in cholera and spinal disease.
Amber color.	Uræmatin.	Add to boiling urine one fourth of its bulk of hydrochloric acid. Pink or purple color produced.	Mostly normal.	Being the urine of health, this color excludes all diseases of which either pale or very high-colored urine is a symptom.
Yellowish-green.	Pigment of bile.	Let a drop of nitric acid fall in the center of a thin layer of urine on a white plate, when a transient play of colors in rings of pink, violet, and green is produced.	Very acid.	Obstruction to the passage of bile from the liver and gall-bladder into the intestines; presence of the constituents of bile in the blood.
Greenish to grass-green.	Mixture of uroxanthin with any of the blue pigments.	Several tests of these substances.	Alkaline, decomposed; much carbonate of ammonia.	Has occurred in cystitis and Bright's disease.
Reddish-yellow to red.	Uræmatin, large amount.	Hydrochloric acid.	Reaction acid. Large amount of solids, particularly urea.	Little liquid taken. Excess of nutritive, nitrogenous matter; free perspiration. Fever.
Red to brown and deep brown.	Coloring principles of hæmatoxylon, chimaphila, coffee.	Coffeurine may be known from the characteristic odor.	Subject to accident.	The ingestion into the stomach of hæmatoxylon, chimaphila, senna, rhubarb, and coffee, or their extracts and infusions.
	Senna.	Mineral acids change the dark red or brownish color of this and rhein into light yellow.		

Color.	Substance to which the color is due.	Shortest chemical test.	Concomitant characters of urine.	Pathological indications.
	Rhubarb.	Liquor ammoniæ converts the dark orange or brown into crimson.		
	Pigment of bile.	Nitric acid.		
Pink or rosy.	Purpurin (uroerythrin).	Is precipitated with deposits of urate of ammonia and soda, and may be combined with them artificially.	Urine always acid, making mostly a deposit of urates on cooling.	Indicates frequently the presence of serious lesions. Rest problematical.
Red to purple.	Urrhodin.	Is a product of decomposition of uroxanthin, and with blue pigments makes the urine violet.	....	....
Blue.	Cyanurin (uroglaucin); indigo.	Let urine decompose, or add concentrated NO_5 or HCl. Pigment is destroyed on evaporation of urine. Concentrated SO_3, $\frac{1}{6}$ to $\frac{1}{4}$ volume, produces a test like that of Pettenkofer for bile. Indigo not affected by boiling with HCl.	Ammoniacal decomposition in the bladder.	Observed in cystitis and Bright's disease. Cyanurin sometimes discharged during apparent health. In that case the urine is of amber-color, and the pigment only appears on addition of acids.
Violet.	Mixture of the red and blue pigments, normal and abnormal.	Those of the separate substances.	....	....
Reddish-brown to brown, porter-like.	Hæmatin.	Coagulable by heat (sometimes); precipitated by acids in flocculi.	....	Typhus. Breathing of arseniureted hydrogen.
Blackish-gray, black like ink.	Hæmatin, and blood becomes black in putrid urine. Tar and creasote, or carbolic acid.	Sometimes as deposit in clear ordinary urine.	....	The ingestion of carbolic acid into the blood, through the stomach or skin.

Respecting the chemical reactions of abnormal urine only little need now be said.

Urine of inordinately high acid reaction is irritating to the mucous membrane of the urinary tract.

Urine of alkaline reaction is also somewhat irritating, but strongly ammoniacal urine causes the greatest distress in the bladder and urethra.

Urine containing uric acid in excess is highly irritating, and even causes cystitis and urethritis. Oxalate of calcium in abundance of octahedral crystals produces the same effects.

Urine containing amorphous phosphate of calcium is ordinarily acid, and causes little, if any, irritation.

Alkaline, slimy urine indicates the presence of triple ammonio-magnesian phosphates.

A marked deficiency of urea in the urine is to be regarded as a serious objective symptom, while a decided excess of urea indicates great expenditure of energy or much waste of tissue from disease, or the excessive ingestion of nitrogenous food and insufficient bodily exercise.

When urine containing an abundance of sugar is retained a few hours in the bladder, fermentation soon begins, and it is not long before cystitis is developed ; the urine then voided being very fœtid, turbid, slimy, purulent, phosphatic, and swarming with microzymes. At the time of its emission a considerable quantity of gas, resulting from this bacterial fermentation, escapes in large bubbles, often to the dismay of the patient, who suspects intestinal implication.

Albumin in the urine indicates renal or vesical disease, the presence of pus or of blood, or, in health, the ingestion of large quantities of albuminous food—such as eggs, etc.

Color.	Substance to which the color is due.	Shortest chemical test.	Concomitant characters of urine.	Pathological indications.
	Rhubarb.	Liquor ammoniæ converts the dark orange or brown into crimson.		
	Pigment of bile.	Nitric acid.		
Pink or rosy.	Purpurin (uroerythrin).	Is precipitated with deposits of urate of ammonia and soda, and may be combined with them artificially.	Urine always acid, making mostly a deposit of urates on cooling.	Indicates frequently the presence of serious lesions. Rest problematical.
Red to purple.	Urrhodin.	Is a product of decomposition of uroxanthin, and with blue pigments makes the urine violet.	....	....
Blue.	Cyanurin (uroglaucin); indigo.	Let urine decompose, or add concentrated NO$_5$ or HCl. Pigment is destroyed on evaporation of urine. Concentrated SO$_3$. ⅛ to ¼ volume, produces a test like that of Pettenkofer for bile. Indigo not affected by boiling with HCl.	Ammoniacal decomposition in the bladder.	Observed in cystitis and Bright's disease. Cyanurin sometimes discharged during apparent health. In that case the urine is of amber-color, and the pigment only appears on addition of acids.
Violet.	Mixture of the red and blue pigments, normal and abnormal.	Those of the separate substances.	....	....
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Dr. Carroll mentions the case of a patient whose urine was albuminous during the period of thirty years, and who died at the age of sixty.

Substances which exist in Normal Urine, but constitute Abnormities when in Excess.

- Urea.
- Uric acid.
- Urates of
  - sodium.
  - ammonium.
  - potassium.
  - calcium.
  - magnesium.
- Hippurates of
  - sodium.
  - potassium.
  - calcium.
- Lactates of
  - sodium.
  - potassium.
  - calcium.
- Chlorides of
  - sodium.
  - ammonium.
  - potassium.
- Creatin.
- Creatinin.
- Oxalate of calcium.
- Sulphates of
  - sodium.
  - potassium.
  - calcium.
- Phosphates of
  - sodium.
  - calcium.
  - ammonium.
- Ammonio-magnesian phosphates.
- Silicic acid.
- Margarin, olein, and other fats.
- Urochrome.
- Vesical mucus.

Substances which do not exist in Normal Urine, and the Presence of which constitutes Abnormities.

- Sugar.
- Calcium carbonate.
- Cystin.
- Pus.
- Chyle.
- Blood.
- Hæmatin.
- Hæmoglobin.
- Albumin.
- Bile.
- Leucine.
- Tyrosine.
- Hypoxanthin.
- Purpurin.
- Spermatozoa.
- Casts of uriniferous tubes.
- Cancer cells.
- Entozoa.
- Tubercle bacilli and other micro organisms.
- Phenic acid.
- Iodine
- Arsenic.
- Antimony.
- Lead.
- Copper and other poisons.

DIAGNOSIS, the discrimination of diseases and the discovery of their character and seat, is effected (1) by analyzing their symptoms, (2) by physical exploration, (3) by recourse to chemical and microscopical examination of excretions or of portions of tissue, and (4) by a synthetic mental process, summarizing the different kinds of information obtained and deducing the sign or indication of the presence of a particular disease.

It often happens that the diagnosis of a disease of the urinary apparatus is extremely difficult owing to most of its symptoms being common to several other diseases of this apparatus. In such a case, as some of the symptoms are not perceptible in all the diseases in question, these diseases are one after another eliminated from consideration until all but two are excluded, when may be employed with advantage the differential method of diagnosis, which consists in the close comparison and proper interpretation of the dominant symptoms, and of the results of the accessory means that may have been employed.

Accurate diagnosis is essential to rational therapeusis and to correct prognosis.

THE PROGNOSIS of a disease of the urinary apparatus—the foretelling of its course and termination—requires a thorough study of its nature, a mature knowledge of its ordinary duration, a searching inquiry into the effect of previous treatment, and a careful observation of the general condition of the sufferer. This also serves to establish the indications of future treatment.

To the patient and to his near relations and friends prognosis is all-important. They desire and have the right to know if he is likely to recover; if so, when; if not, what will be the probable duration of life, what the extent of his suffering, if it can be alleviated, and, finally, if a cutting operation is indicated; if not, why it is contra-indicated.

The prognosis is unfavorable in cases of advanced renal disease complicating urethral stenosis, prostatic obstruction, and stone in, and tumors of, the bladder of long standing. In such cases cutting operations are clearly contra-indicated as most likely to shorten the patient's life, which judicious palliation renders endurable.

In malignant disease of any of the organs of the urinary apparatus, with contamination of the lymphatics, the prognosis is unfavorable, and cutting operations are contra-indicated. Palliative treatment should, however, not be neglected.

In advanced tuberculosis of the urinary apparatus the prognosis is unfavorable, and palliative measures only are indicated.

Close attention to prognosis tends to prevent recourse to painful and dangerous therapeutic means, or to cutting operations, which seldom, if ever, relieve suffering while they rapidly lead to a fatal issue.

THE PROPHYLAXIS of several diseases of the urinary apparatus may be effected by avoidance of contagion, by abstention from excesses, by due observance of the rules of hygiene, by the use of prophylactic medicinal agents, or by early surgical interference.

The formation of calculous concretions may be prevented by timely general treatment of hyperlithuria, by frequently withdrawing stagnant alkaline urine from the bladder and cleansing it, or by the early removal of foreign bodies.

Ureteritis, ectasia of the ureters, pyonephrosis, and pyelonephritis may all be prevented, in cases of urethral stenosis and of prostatic obstruction, by early attention to the contracted urethra and to the bladder.

The complete cure of urethritis is often preventive of stenosis of the urethra.

The prompt resort to external perineal urethrotomy, followed by dilating catheterism in transverse wounds of the perineal portion of the urethra, is preventive of those traumatic stenoses which are so fatal to sufferers.

The judicious use of quinine during the surgical treatment of diseases of the urinary apparatus is often preventive of the intercurrence of rigors, and, when these have already begun, palliates them and often prevents their recurrence. The administration of minim doses of aconite tincture is of great value in the febrile reaction which so frequently occurs after operations, or in diseases of the urinary organs, even in urethritis.

THE GENERAL THERAPEUSIS of diseases of the urinary apparatus implies a good understanding of the principles of action, indication, and application of means of palliation and of cure, is an indispensable prerequisite to the efficient management of particular diseases of the organs of this apparatus, and is deduced from general pathology, from a practical knowledge of the effects of medicinal agents, and from a study of the results of surgical processes. Only general principles are thereby established, no fixed rules can be rational, for many circumstances arise that lead the physician to modify his treatment even of the same patient, and he has no other guides than are afforded by mature experience, quick perception, sound judgment, a cool head, and a steady hand. Too much haste to do for a patient is often productive of much harm. In certain difficult, doubtful cases, how much better it is to do nothing than to do the wrong thing, or to do the right thing at the wrong time or in a way that is almost certain to be injurious and perhaps fatal to the sufferer! In these circumstances, a little delay, sufficient to bring into play the reasoning faculties, is most wholesome and enables the physician to exercise his skill greatly to the advantage of the patient.

Among the inexperienced there is a strong tendency to overdo the right thing, the result being that the sick man, thus tormented by meddlesome medicinal and manual medication, becomes fretful, his body temperature rises, his pulse is quick and frequent, he is sleepless, and his appetite vanishes. These phenomena are not properly interpreted; a consultation is finally called, and the advice is, too much of the right thing has been done; cease all interference and let the patient get well.

A young surgeon, filled with enthusiasm, eager for glory anxious to do his whole duty, well informed in all the modern devices, has just taken charge of his first case of narrow stricture in the phallic region of the urethra. He decides to perform internal urethrotomy and subjects his patient to the most rigid preparatory treatment. He sterilizes the urine with free doses of oil of gaultheria, which are to be continued throughout the after-treatment, administers quinine without stint as a prophylactic of urethral fever, disinfects his instruments, injects a good quantity of a four-per-cent. cocaine solution, executes the operation, successfully arrests the consequent hæmorrhage, resorts to dilating catheterism once each day, and causes the urethra to be injected every two hours night and day for a week with a 1-to-5,000 sublimate solution, adding thereto a liberal amount of boric acid and peroxide of hydrogen. At the expiration of this time he is alarmed to find his patient so ill, with loss of appetite and sleep, with fever and the accompanying fretfulness, and with an extremely sensitive and irritable urethra, that he requests a consultation. The consulting physician listens patiently to a detailed recital of the whole case, and, taking the attending surgeon to an adjoining room, says he is greatly surprised to find the man alive after being subjected to the torture of so much unnecessary medication, and advises its immediate cessation. From that moment the patient begins to improve, and is allowed to get well by being catheterized only once a week. This is no exaggeration, but a true picture of a not infrequent occurrence.

It is almost needless to say that diseases are not cured by medicines or by surgical operations. In the first case, drugs are given to remove the cause by destroying its morbific agency, whatever it may be, and in the second case an operation is performed to remove an obstruction, a growth, or a foreign substance, or to relieve a distended bladder, which may be disturbing the bodily functions; Nature effects the cure.

The general principles of treatment of diseases of the urinary apparatus relate to means by which a disease is cured or palliated and by which the individual may be placed in the most favorable condition to resist its effects; therefore quite as much attention should be bestowed upon the treatment of the patient as upon the management of his disease. Suitable hygienic precautions, a wholesome alimentation, the judicious use of stimulants, and such other analeptic measures as may be indicated, form the basis of the treatment of the patient. The disease may require medicinal as well as mechanical means. For instance, to relieve pain, to eradicate a poison, or to destroy an infective agent, drugs known by experience to possess hypnotic, neutralizing, or specific properties are indicated—as anodynes to relieve pain, sterilizing agents in urethritis, and mercury in syphilis. Operations, such as catheterism to relieve retention of urine; lithotomy or lithotrity for the removal of stone from the kidney, bladder, or urethra; dilatation, divulsion, or urethrotomy for the cure of stricture; nephrotomy to relieve pyonephrosis; nephrectomy for certain diseased kidneys; and cystotomy for the excision of vesical tumors. An accurate diagnosis, a sound judgment of the indications of special processes, and a masterly operative skill are absolutely necessary to the successful management of a particular disease.

The greatest caution should be exercised in prescribing some of the medicinal agents required in the treatment of affections of the urinary organs. Among these opium should be particularly mentioned for two among many good reasons: First, because of its known property to lessen the urinary secretion, which is sometimes a most dangerous consequence, and, second, because long sufferers from gravel, stone, and other painful affections are apt to acquire the "opium habit," beginning with small doses and gradually increasing the quantity until the habit is fixed. Valuable as is this drug, it should rarely be used and given only in case of the most urgent necessity.

Stimulating diuretics are also dangerous and should therefore be avoided. Mild diluents and diaphoretics should be employed in their stead.

A few words may not be out of place concerning certain questions asked by junior members of the profession, to wit:

1. What is the duty of the surgeon when it is difficult or not possible to determine the character and extent of an operation which may be indicated by a pathic condition the nature of which can not be ascertained until the parts are exposed to view by the knife?

2. Is the surgeon justified, immediately after an ex-

ploratory operation, to proceed to the final operation against the consent of the patient; that is to say, if the patient had refused to submit to anything more than an exploratory operation?

3. Is the surgeon justified, without the consent of the patient, to proceed to the final operation at the conclusion of the exploratory operation while the patient is under the influence of the anæsthetic agent?

These questions may be answered as follows:

1. The duty of the surgeon is to employ all the means of diagnosis at his command before proposing an exploration which involves the use of the knife, and, failing, his further duty, if there be time, is to submit the case to another surgeon for his diagnosis, opinion, and advice. If then an exploratory operation be advisable, its nature and also the character and extent of the operation likely to be indicated by the exploration should be fully explained to the patient.

2. If the patient refuse to submit to anything more than the exploratory operation, the surgeon is not justified to proceed beyond the exploratory operation.

3. Under no circumstances is the surgeon justified, without the consent of the patient, to proceed further than the exploratory operation.

What is then to be done, asks the junior surgeon, if the wound inflicted in the exploration is such as to be remediable only by the final operation, or such that the patient may die unless the final operation be at once performed?

The answer to this question is that the experienced surgeon is not likely to place himself in such a position, nor to entertain the thought of undertaking an exploration without having had a distinct understanding with the patient that he must trust to the judgment of the operator as to what the exploration may indicate, and give his full consent to the performance of the necessary operation. If the patient refuse to enter into this agreement, the surgeon is justified in declining to operate or even to continue in charge of the case.

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SECTION II.—*SPECIAL CONSIDERATIONS.*

IV.

INTERSTITIAL NEPHRITIS, PYELONEPHRITIS, AND PERINEPHRITIS; THEIR NATURE, SYMPTOMS, PROGRESS, DIAGNOSIS, AND TREATMENT.

THE phlegmasic, being the most common of the affections of the urinary organs, should be first examined. The kidneys, ureters, bladder, prostate, bulbo-urethral glands, and urethra, are all subject to phlegmasia with varying degrees of frequency. These affections will be discussed in the order in which the several urinary organs have just been enumerated, beginning with nephritis.

Nephritis—phlegmasia of the kidney—may be secondary to some affection of organs other than the urinary, or to some affection of the lower urinary organs, or may occur as a primary disease. The substance of the kidney only may be affected—nephritis; or the enveloping tissue of the kidney may alone be affected—perinephritis. Nephritis may extend to the enveloping tissue and cause a secondary perinephritis, and a primary perinephritis may extend into the kidney substance and cause a secondary nephritis.

INTERSTITIAL NEPHRITIS.—The species of nephritis that particularly concern the surgeon are interstitial nephritis, pyelonephritis, and perinephritis. By interstitial nephritis is meant a phlegmasia of the intertubular substance of the kidney; by pyelonephritis, improperly termed surgical kidney, is meant a phlegmasia involving the mucous membrane of the renal pelvis and the intertubular substance of the kidney; and by perinephritis is meant a phlegmasia affecting the layer of connective and adipose tissue that invests the kidney. In these cases the phlegmasia may be superacute, acute, subacute, or chronic. It may be descending or ascending.

Descending nephritis is ordinarily secondary to disease of some organ foreign to the urinary apparatus, or to the ingestion of medicinal agents or of poisons; while ascending nephritis is secondary to disease of the lower urinary organs, or to catheterism and other operations upon the urethra or bladder. Both kidneys are generally involved, but in an unequal degree. Descending nephritis may arise without microbic invasion, or may be the result of microbic invasion; therefore it may be amicrobic or microbic.

Descending amicrobic nephritis is the outcome of long-continued abuse of alcoholic beverages, of large doses of potassium iodide and other irritants, or of persistent hyperlithuria. The primary effect of any of these irritants is upon the epithelial cells of the uriniferous tubes, which undergo a molecular necrotic process and are cast away in great numbers. Thus the morbid action is at first parenchymatous, but later diffuses itself and reaches the fibrous tissue and the blood and lymph-vessels constituting the intertubular substance. The kidney greatly swells from plasmatic exudation, consisting largely of leucocytes, and this product of the plegmasia gradually undergoes incomplete organization and finally sclerous degeneration and contraction, rendering the organ nodular and causing it to shrivel, often to less than half its normal dimensions—a condition which is common among persons far advanced in age. This was formerly designated as cirrhosis, but is now known as sclerosis of the kidney, and is ordinarily associated with hepatic sclerosis. The sclerosed kidney is so vulnerable that the copious ingestion of irritants, such as occurs during a debauch, or inhalation of ether necessary to the performance of a surgical operation upon the urethra or bladder, is likely to interrupt or even abolish the function of urination, or to induce a superacute phlegmasia, which proves fatal in a very short time. In such circumstances miliary purulent foci are often found on close necropsic inspection of the kidneys.

An intemperate man of middle age, brought to Bellevue Hospital in the year 1870 on account of a luxation of the left hip, was etherized for the reduction of this luxation, which could not be effected after more than an hour of manipulation. In two days he was again etherized, and kept for an hour under the influence of the anæsthetic agent, during which renewed attempts at reduction were made, but with no better result. It was ascertained on the next morning that he had not urinated. A catheter was then introduced and no urine escaped. He died comatose forty-eight hours after the last attempt at reduction of the luxation. The necropsy revealed sclerosis and extreme irregular contraction of both kidneys. There was no urine in the bladder. It was evident that acute phlegmasia had been superinduced by the large quantity of ether eliminated.

Similar fatal results have since been noted in a number of cases from elimination by the kidneys of large quantities of ether which had been required for anæsthesia during prolonged surgical operations.

The inhalation of ether, even for a comparatively short time, has proved so dangerous to patients with diseased kidneys that, in case of urgent necessity for surgical interference, nitrous oxide should be substituted as a much safer anæsthetic agent, and this precaution may advantageously be taken in doubtful cases, or even when the kidneys are not supposed to be diseased.

In cases of persistent hyperlithuria it occasionally happens that some of the uriniferous tubes are blocked by aggregations of uric-acid crystals. These infarctions may give rise to retention cysts in the kidney, to chronic interstitial nephritis, or to acute interstitial nephritis ending in necrosis of the surrounding tissues and the formation of miliary abscesses, or cause one large chronic abscess, which finally communicates with the renal pelvis. If in the last case the ureter is even incompletely obstructed, ectasia of the renal pelvis follows.

About a year ago a case of renal abscesses and pyonephrosis was observed which seemed to be attributable to this cause. Lumbar nephrotomy was performed by Dr. H. M. Silver, and at least a quart of pus escaped. There was also a secondary perinephric abscess. The wound healed in the course of three months, but, as there was an increasing swelling at the seat of disease during the fourth month, the doctor performed nephrectomy, and found an abscess in the substance of the kidney. The patient made a good recovery, and when last seen appeared to be well.

Hydronephrosis and pyonephrosis will be further examined under the section ectatic affections.

Descending amicrobic nephritis is generally subacute and of very slow development, whether caused by alcoholism, by the ingestion of other poisons, or by hyperlithuria. It is latent, and all subjective symptoms are therefore wanting, and the objective symptoms are few. Its diagnosis is based principally upon the knowledge of the effects of these irritants which prepare the kidneys for an accession of acute phlegmasia from any of the causes that have already been detailed. The fact to be constantly borne in mind is that the kidneys of persons addicted to alcoholic excesses, or subject to hyperlithuria, are nearly all diseased to a greater or less extent and very vulnerable, easily attacked by any of the forms of acute phlegmasia and incapable of resisting their ill effects. Consequently, the greatest circumspection should be exercised in the indication of surgical operations upon such subjects, and in selecting the anæsthetic agent.

Descending microbic nephritis arises from infectious emboli in cases of pyosapræmia and of ulcerative endocarditis. The phlegmasia, in such cases, is caused by the mechanical occlusion of small renal blood-vessels and consequent necrosis of the intertubular substance, leading to the formation of multiple purulent foci which sometimes coalesce and form a single large abscess. In this case the phlegmasia is superacute, fulminating, and fatal in a very short time.

Ascending nephritis may be amicrobic or microbic.

Ascending amicrobic interstitial nephritis occasionally follows surgical operations, even such as simple catheterism, and is generally subacute and bilateral. Sometimes, however, it is superacute and occurs, though with extreme rarity, in previously healthy kidneys. This interstitial nephritis is also the outcome of ureteric obstruction, partial or complete, whether from pressure by a neighboring growth, from an impacted urolith, from a growth in the ureter itself, or from stenosis of the ureter. It ordinarily affects only one kidney. In exceptional cases, both ureters being partially obstructed, both kidneys suffer. Roberts, of Manchester, England, and other observers relate cases of fatal anuria from complete obstruction of both ureters by impacted uroliths. Obstruction of one of the ureters from any of the several causes just mentioned gives rise to retention of urine in, and to ectasia of, the renal pelvis, or even of the straight uriniferous tubes—hydronephrosis; and the consequent hydraulic compression is such as to cause nephritis with final destruction of the kidney structure, leaving little more than a multilocular sac of fibrous tissue. Long-standing hydronephrosis sometimes becomes pyonephrosis from sudden local necrosis due to disturbance in the blood-supply of such renal tissue as may have been intact.

Amicrobic pyelonephritis is sometimes caused by the presence of a urolith or of several uroliths in the renal pelvis, and is designated as calculous pyelonephritis. The pus in these cases consists of migrated leucocytes that have passed through the mucous membrane to attack the urolith and have died in their struggle to destroy the irritating host.

Symptoms.—When acute interstitial nephritis is due to catheterism or to some other surgical operation, its symptoms are a chill lasting from fifteen to forty-five minutes, followed by febrile reaction, or recurring slight chills of very short duration, and a rise of body temperature at night from 100° to 102° F. This nightly rise of temperature and the consequent sweating disturb the patient's sleep, his pulse is unduly frequent, his appetite vanishes, his tongue is furred and sometimes dry, he is more or less nauseated, and at times vomits his food ; he is distressed by flatulency, and rapidly emaciates. During the day the skin is dry and harsh. The complexion is pale and sallow. There is no deep-seated pain in the region of the kidney, but only some lumbago. The urine gives no positive indication, except, of course, in the case of oliguria and of chronic diffuse nephritis with casts of the uriniferous tubes. Some of these symptoms may be noted for several weeks and then be no longer appreciable. Resolution may or may not have occurred, and on slight provocation, such as an untimely catheterism, the phlegmasic process may be rekindled and run a rapid course toward a fatal issue. When, however, resolution is fairly established the patient soon apparently regains his normal condition, but his kidneys are vulnerable and very liable to be again diseased. When this condition is provoked by catheterism it is designated as urethral, urinary, or catheter fever.

The diagnosis of acute interstitial nephritis is not easily made. Although this phlegmasia may occur without the provocation of catheterism or of other operations, it is generally caused, directly or indirectly, by some sort of surgical interference—directly by instrumentation, and indirectly by the irritation of the kidneys through their elimination of a large proportion of the ether necessary for anæsthetic purposes, or by the introduction of foreign elements, such as micro-organisms, etc.

It is often difficult to distinguish acute interstitial nephritis from the septicæmic condition induced by the absorption of stale urine, from pyosapræmia, or even from continued fever. Therefore the closest inquiry into the symptoms in connection with the pre-existing state of the patient and the nature of the ætical factor or factors is necessary to a correct diagnosis.

The prognosis of acute interstitial nephritis is good when the phlegmasia attacks normal kidneys, but is doubtful, if not positively bad, when it attacks kidneys that have already suffered. When, in previously normal kidneys, acute interstitial phlegmasia occurs, resolution, under favorable circumstances, begins in the course of a week, and the patient is soon well. But in already diseased kidneys the phlegmasic process is liable to end in suppuration. If both kidneys suppurate, oliguria, anuria, and death ensue. However, oliguria, and even anuria, are not necessarily indications of suppuration of the kidneys, for either may last several days in patients that ultimately recover from acute nephritis. A patient treated twenty years ago for anuria which lasted four days is still alive.

Anatomical Characters.—On gross inspection of kidneys, removed after death from acute interstitial nephritis, their capsule is found adherent and somewhat opaque, and its vessels are distended with blood. When split open along the outer border the substance bulges on account of the sudden release from compression of the intertubular exudate. It is softer than natural, except in cases of old sclerosis, where it is hard and nodular. The renal pelvis is sometimes in a phlegmasic state, and contains alkaline purulent urine. The pyramids are red in some cases, pale in others, and streaked with lines of purulent exudate. In the cortical substance there are often great numbers of miliary purulent foci distinctly visible to the naked eye.

Microscopical examination verifies the purulent character of the exudate in the intertubular substance of the straight and convoluted tubes.

Treatment.—In cases of disease of the lower urinary organs the liability of secondary renal disease is not to be underestimated, and measures likely to be preventive of acute interstitial nephritis should invariably be taken in the management of such cases. These measures consist in the administration of diluent drinks, of quinine in small doses, of tincture of the chloride of iron in five-minim doses, etc. If there is stagnant urine, it should be carefully drawn off and the bladder cleansed at least once each day with antiseptic solutions. If there is urethral stenosis, cautious slow dilatation should be resorted to and the greatest care observed in catheterism. The patient should be protected against inclement weather and kept indoors. If there is stone or any other affection in the bladder, or intractable urethral stenosis, indicating an operation, the most rigid preparatory treatment should be instituted. When acute interstitial nephritis occurs in previously normal kidneys, and the diagnosis is promptly made, it is desirable to strive to effect deliquescence of the phlegmasic process. This deliquescence can, however, be effected only during the earlier period of the invasion. To this end, free wet cupping in the lumbar regions, followed by hot fomentations, should at once be practiced, and a hydragogue cathartic administered. Even if deliquescence does not occur, this treatment is likely to shorten the process of resolution. During the treatment diaphoretics should be freely employed, and the skin well sponged with warm water and alcohol two or three times daily, and the under-garments changed each time.

When acute interstitial nephritis affects already diseased kidneys, although the chances of recovery are decidedly lessened, the treatment should not be abandoned, but should be as active as in the case in which an attempt is made to effect deliquescence.

ASCENDING MICROBIC PYELONEPHRITIS is the outcome of neglected urethral or prostatic obstruction, vesical stones, tumors, tuberculosis, entozoa, foreign bodies, or injuries and diseases of the spinal cord leading to paraplegia, causing stagnation and fermentation of urine in the bladder, and of the use of unclean surgical instruments, particularly catheters. The phlegmasic action creeps up the ureters and reaches the renal pelves and uriniferous tubes, where several species of bacilli and micrococci find abundant sustenance, multiply rapidly, and finally, invading the intertubular substance, constitute one of the mechanical factors in the suppuration which generally occurs in both kidneys. The process at first may be very slow, and the struggle between the leucocytes and microbia may last several weeks or months, in rare instances several years, when suddenly, perhaps, on the accession of new colonies of these microbia, it becomes very rapid, and sometimes death is hastened by the supervention of a superacute phlegmasia thus induced or incited by an operation which, under the circumstances, no prudent surgeon would countenance. Most of the cases of fulminating pyelonephritis with multiple renal abscesses following surgical operations occur in patients who had long suffered from chronic interstitial nephritis, either descending or ascending, consequent upon chronic alcoholism, hyperlithuria, or obstruction of the lower urinary organs.

The symptoms of this form of pyelonephritis are similar to, but more pronounced than, those of acute interstitial nephritis. The body temperature rises higher. Sometimes the phlegmasia is ushered in by a violent chill; sometimes the chill does not occur until excited by a catheterism or other operation which ends fatally within two or three days—fulminating urinary fever—and at other times there occur every day or two slight chills, which continue during two or three weeks, and lead the unwary to think that the patient is suffering from intermittent fever. It is to be noted that the body temperature in these cases is higher at night and that it often rises above 105°. When pyelonephritis is subacute and due to long-continued urinary obstruction there is generally dull continuous pain in the lumbar region and tenderness to pressure in the course of the ureters, which are also involved in the phlegmasia and more or less dilated by the column of dammed-up urine, which contains a considerable quantity of creamy pus. Emaciation is progressive and rapid; flatulency, nausea, and vomiting are frequent. The features are sallow and pasty; the tongue is dry, brown, and fissured. Finally, there are, drowsiness muttering delirium, oliguria, and anuria.

The diagnosis is based upon the history of the disease and the characters of its symptoms, but in some cases the characteristic symptoms are masked or there are no predominant symptoms, and the nature of the affection is not known until revealed by the necropsy.

The prognosis of microbic pyelonephritis is bad, but the affection, as before stated, may last long—that is to say, the patient may survive an attack of subacute pyelonephritis many months, and in some cases one, two, or three years. The acute and superacute types terminate fatally in from one to four weeks, delirium, oliguria, and anuria supervening a few days before death.

The gross necropsic appearances of the kidneys vary in degree, but are of the same kind. The capsule is adherent, the kidney substance is soft, sometimes pulpy and yellowish, and mottled with congested blood. The pelves and calices are dilated to a greater or less extent and their mucous membrane is red in patches, seldom of uniform redness, coated with a thin layer of slimy pus, and the pelves and ureters are filled with highly purulent urine, the ureters being more or less dilated.

Microscopical examination reveals dilatation of the straight uriniferous tubes, and streaks of pus with colonies of bacteria within and between these tubes, purulent foci in the cortex, and here and there blood infarctions. The epithelial cells of the cortical tubes are opaque and swollen and many of them in a necrotic state. The intertubular substance is infiltrated with bacteria and with leucocytes which have been vanquished in their struggle with these microbia and have consequently become pus. The microbia even reach the glomeruli, many of which are shriveled, and their capsules appear to be thicker than normal.

Treatment.—In the management of microbic pyelonephritis it should be remembered that any unrelieved source of urinary obstruction leads to stagnation and fermentation of urine in the bladder, causing in time grave alterations of structure in the kidneys, to which palliative measures only are applicable. In the case of urethral stenosis these palliative measures consist in gradual dilatation of the strictured urethra. In the case of prostatic obstruction, they consist of periodical evacuative catheterism. In both cases they consist in counteracting fermentation of urine in the bladder by frequent irrigations with antiseptic fluids.

The quantity of urine passed each day should be constantly kept in view. In case of oliguria or of polyuria, prompt measures should be taken tending to re-establish the normal secretion of the urine. In case of oliguria, which is sometimes the forerunner of anuria, mild diuretics and diaphoretics are indicated. Digitalis infusion and small doses of alkaline diuretics, such as acetate or citrate of potassium, and borage tea, or any other similar beverage, answer the purposes of diuresis and diaphoresis. In case of polyuria, ergot extract in pills may be given in doses of two or three grains, repeated three or four times daily. Gallic acid, in five-grain doses dissolved in glycerin, is also sometimes useful in cases of excessive polyuria. The remainder of the general medication consists in opiates to relieve pain, diluents, occasionally moderate doses of benzoic acid and biborate of sodium, reconstituents, mild stimulants, and a properly regulated diet. Such local and general medication greatly promotes the comfort of patients, and in some instances helps to prolong life.

PERINEPHRITIS—phlegmasia of the connective-adipose envelope of the kidney—arises as an acute, a subacute, or a chronic affection. In the first two states this phlegmasia may speedily resolve, or resolution may be imperfect and end in chronic induration of the adipose capsule, or suppuration may take place and a vast perinephric abscess may be formed. The chronic may begin without previous acute or subacute phlegmasia, and may be discovered only after death.

Rayer, Féron, Hallé, Trousseau, Naudet, Lecygne, Poland, Dickinson, Duffin, Ebstein, Nieden, Bowditch, Gibney, Morris, and many others have elucidated the nature, ætiology, semeiology, diagnosis, and therapeusis of perinephritis, and more than a hundred special articles on the subject have been published in the last thirty years.

Rayer collected, in 1839, a number of published cases of abscess in the ilio-costal region, and described with masterly accuracy and, having defined, named perinephritis this phlegmasia of the cellulo-adipose capsule of the kidney.

This affection occurs at nearly all periods of life from the first few years to advanced age. In an interesting series of papers, Dr. V. P. Gibney reports twenty-eight cases of perinephritis in children, of which five were under three years of age, twelve between three and six years, eight between six and ten years, and three between ten and fifteen years. Thirteen of these were males and fifteen were females. The right side was affected in six and the left side in seven of the males. The right side was affected in eight and the left side in seven of the females.

Of one hundred and sixty-six cases reported by Nieden, twenty-three were under fifteen years of age.

Naudet regards perinephritis as an affection of adults, as rare in old age and still more rare in childhood, and does not seem to have known of a sufferer from this ailment younger than ten years.

Lecygne is of opinion that perinephritis occurs mainly during the most active periods of life—*i. e.*, from the ages of thirty to sixty, then from ten to twenty.

The question of this relative frequency can be decided only by the analysis of many thousands of cases.

Perinephritis sometimes occurs as a primary affection, which may or may not result from injury, but which is independent of any kidney lesion. It is oftener consecutive to injuries or to affections of the kidney—such as nephric abscesses, pyelitis, pyonephrosis, pyelonephritis, calculous concretions, parasites, tuberculosis, malignant disease, etc. —and it is also consecutive to caries of the vertebræ, ulceration of the small intestine and colon, and to disease of other organs.

Primary perinephritis is said to be occasionally due to dyscrasic influences such as give rise to gout and rheumatism, but most commonly it is due to strains, contusions, and wounds.

Of the one hundred and sixty-six cases of perinephritis collected by Nieden, twenty-four were primary.

Contusions, strains, and falls were the causes in eight of Dr. Gibney's twenty-eight cases; in nineteen of these cases the exciting cause could not be ascertained.

Of twenty-eight cases of perinephric abscess due to primary perinephritis, tabulated by Poland, the causes are stated as follows: Falls and contusions in three cases, jolting in carriage in one, fatigue in walking in one, muscular effort (digging) in three, debility in one, uncertain and insidious in four, no assignable cause in six, cause not stated in six, and doubtful in three cases (Morris).

Secondary perinephritis is most frequently consecutive to renal affections. A nephric abscess may be so near the surface of the kidney that perinephritis is soon established by this propinquity, but some time may elapse before the nephric abscess opens, if it open at all, into the peripheral pus cavity. In the case of pyonephrosis the pus may pass through a perforation of the wall of the dilated renal pelvis into the peripheral connective tissue and cause an extensive perinephric abscess, just as in pyelonephritis the tissue destruction and the communication may be through the substance of the kidney. This is sometimes effected by the irritating presence of a calculus, of parasites, of tuberculosis, or of malignant disease.

In a case of left perinephric abscess seen in consultation eleven years ago the necropsy showed the suppuration to be owing to urinary infiltration due to the destruction of renal tissue by the rapid extension and softening of malignant disease primarily affecting the kidney.

In a large proportion of cases perinephritis is consecutive to disease of organs other than the urinary, such as perforation of the ileum, colon, or gall-bladder, as perityphlitis, pulmonary abscess, or caries of the vertebræ, and even to affections of, and operations upon, some of the pelvic organs. The kidney substance is sometimes attacked and in part destroyed by the phlegmasia which began in the peripheral adipose tissue, so that pus is discharged into the urinary bladder.

Of twenty-six cases of perinephric abscess collected by Duffin, twelve were consecutive to affections of organs other than the urinary.

The symptoms of perinephritis vary with the cause and the intensity of the phlegmasic process. In primary perinephritis, supposed to be due to dyscrasic influences, the phlegmasia being subacute, there is, in the lumbar region, a constant dull pain sometimes regarded as simple lumbago, and many months may elapse before tumefaction and tenderness to pressure are appreciable. The movements of the patient, though somewhat impeded, intensify the existing local pain, which is then propagated to the thorax, to the inguinal region, and even to the lower extremity. This irradiation of the pain leads the sufferer to believe himself the subject of muscular rheumatism, and the nature of his real ailment is unrecognized until a marked tumefaction is revealed and fluctuation detected. Meanwhile he had often had a rise of body temperature and had been restless at night, his appetite had vanished, he had sometimes vomited his food, had been distressed with flatulency and constipation, emaciation had begun, his strength had failed, and for several weeks he had been unable to make even slight muscular exertion without greatly increasing his local pain, and unable to extend the thigh on the affected side without much suffering. In these cases the urine gives no indication other than the presence of an abundance of urates, with high specific gravity.

When primary perinephritis is the outcome of a severe contusion or some other grave injury, the symptoms are more quickly appreciable as a general rule. The phlegmasia being acute in the majority of cases, the pain is greater and is much intensified by movements of the lower limbs, and, though this pain follows the course of the lumbar and sciatic nerves, its point of greatest intensity is the loin, which is hard, tense, bulging, and tender to pressure. In the course of ten or twelve days the pain is lancinating, excruciating from pressure by increased exudation, and at nightfall come rigors and febrile reaction. The thigh is flexed upon the pelvis for the relief in part of the existing tension and pain. A marked swelling then occupies the ilio-costal space, and sometimes extends inward toward the median line and downward into the iliac region. These parts are œdematous, and the œdema spreads into adjacent tissues upward upon the thorax and downward into the inguinal, gluteal, and femoral regions, rendering difficult the detection of fluctuation in the lumbar region. The integument in or about the ilio-costal space sometimes assumes an erysipelatous redness, an indication that the pus is rapidly extending itself toward the surface.

The symptoms of consecutive perinephritis, whether due to nephric abscess, to pyonephrosis, or to diseases of other organs, are similar in kind but not in degree to those of primary perinephritis. But these symptoms are often masked by those of the particular affection which has caused the perinephritis. For instance, pyonephrosis is diagnosticated, an operation is decided upon, the incision in the flank is made, a few ounces of pus flow from an unsuspected perinephric abscess, and the swelling is little diminished until a deeper cut is made, when perhaps a quart of pus escapes from the dilated kidney and the swelling vanishes. This happened in the case cited to illustrate pyonephrosis due to partial obstruction of the ureter.

In the case of consecutive perinephritis due to calculous pyelonephritis, many months or even years may elapse before the symptoms are manifested, and while the nature of the pyelonephritis is ascertained partly through the occurrence of repeated attacks of nephritic colic and the expulsion of small calculi by the natural passage, the perinephritis is undiscovered until a lumbar operation reveals its existence.

The same difficulty occurs in the perception of the symptoms of consecutive perinephritis due to disease of other organs by which it is masked until the swelling at the ilio-costal space is well defined.

In children the symptoms of consecutive perinephritis are even less appreciable than in adults, for they often closely simulate those of spinal and hip-joint disease until the ilio-costal tumefaction is evident, this affection and spinal caries sometimes coexisting.

The progress of perinephritis may be so rapid that its several stages follow in quick succession and the termination may be resolution or gangrene, but most commonly it ends in the formation of an abscess within ten or twelve days; or this progress may be very slow and suppuration may not take place for many months or years after the beginning of the phlegmasic process.

Under favorable circumstances the process of resolution ends in from two to three weeks.

The early writers on this subject; particularly Rayer, considered resolution to be an extremely rare termination of perinephritis, but later experiences, with early and accurate diagnosis, and perhaps improved therapic measures, give a fair proportion of cases of primary perinephritis that have terminated in resolution without suppuration.

Rayer does not appear to have seen a single case of perinephritis terminate in resolution without suppuration.

Hallé cites only one case which appeared to be a perinephritis and ended in resolution, but he had a doubt as to the correctness of the diagnosis.

Trousseau reports a case in which the diagnosis of acute primary perinephritis was undoubted, and which terminated in resolution without suppuration.

Naudet mentions only one case which resolved without suppuration.

Twelve of Gibney's twenty-eight cases (1876 to 1880) ended in resolution without suppuration.

Further examination of the question will probably show that resolution occurs oftener in primary perinephritis than it even now appears.

Gangrene is a very rare termination of perinephritis. Rayer cites only two cases, one of which he credits to Dr. Thomas Turner (1812) and the other to Blaud (1818). In Turner's case, he says, the affection was fulminating and the patient died at the end of the second day. The autopsy revealed gangrene of the adipose capsule of both kidneys, forming a black, pulpy mass. In Blaud's patient the gangrene was probably due to urinary infiltration of the adipose capsule.

When suppuration occurs, its duration varies with the cause of the perinephritis, the general condition of the patient, and the direction taken by the pus. In perinephritis due to perforation of the renal pelvis or substance by a stone, the suppuration persists until the calculous mass is removed or discharged, weeks, months, or years after its formation.

In a case of perinephric abscess opened by the late Dr. James R. Wood, pus continued to flow through a lumbar fistula for more than fifteen years. Occasionally this fistula was obstructed by small stones which were finally expelled.

The ordinary course taken by the pus of perinephric abscesses is backward in the lumbar region, but it has been known to burrow downward into the pelvic cavity and open into the bladder, rectum, or vagina, down into the gluteal and even the femoral region, or upward into the pleural cavity and cause empyema, into the lung and there cause a secondary abscess which, if it open into a large bronchus, is expectorated, or it may open into the stomach or some other part of the intestinal tract. It very rarely enters the peritoneal cavity.

What may be the average duration of perinephritis is another question which can be answered only after the analysis of great numbers of well-recorded cases. However, this phlegmasia, when uncomplicated, runs the course of phlegmasiæ in general.

In twenty-seven of the twenty-eight cases treated by Dr. Gibney, the phlegmasia "ran its course in an average period of about three months and a half." This includes the twelve cases which ended in resolution. One case not included in the computation "seemed to extend over a period of two years and a half."

In the great majority of cases of perinephritis terminating in suppuration the phlegmasic process is quickly modified, and often as quickly arrested as soon as free exit is given to the pus.

A case seen with Dr. Stephen Smith in January, 1891, is a fair illustration of the rapidity of cure sometimes afforded by free incision and thorough disinfection. The patient, a man of twenty-seven, had been ill for six weeks from pain in the right loin, but could give no further account of himself. At the time of the visit he appeared dazed and typhic. The ilio-costal space was prominent, the integument in that space was œdematous and red, and the œdema and redness extended into the inguinal region. A question arose as to whether the case was one of perinephritis or perityphlitis, or of both, but Dr. Smith was inclined to believe that the swelling was due to a suppurating perinephritis. An exploratory operation was advised, and was performed on the following day. The abdominal cavity was opened, but no perityphlitis was found, and the wound was closed. A lumbar incision then gave issue to a copious flow of thick, greenish pus. The abscess cavity was thoroughly washed with a solution of mercuric chloride, a drainage-tube was introduced, and the wound stitched. From that moment there was no more pus formation, and in twenty-five days the parts seemed entirely consolidated, the drainage-tube having been retained two weeks for periodical irrigation.

The diagnosis of perinephritis is often attended with difficulties, particularly in its early stage before tumefaction is palpable, and it is sometimes difficult even after the occurrence of suppuration. In primary perinephritis the history of injury in the lumbar region is of great help, but the patient may not then remember to have been hurt, and the cause of his ailment may be unknown. At its onset the deep-seated local pain is worthy of consideration, though it is not strictly a diagnostic symptom, as it may arise from some other cause, such as typhoid and eruptive fevers, and it may be several days before this pain can be distinguished from that which characterizes these fevers. A point worth bearing in mind is that in typhoid and eruptive fevers the pain is in both lumbar regions, is irradiated throughout the muscular system, and is attended with great general lassitude and prostration.

Later, when tumefaction is manifest, it may be confounded on the left side with splenitis, or with impaction of fæces in the descending colon; on the right side with hepatic abscess, or with typhlitis or perityphlitis; and on either side with renal abscess. Here again the diagnosis is arrived at by the method of exclusion.

Still later, when suppuration has taken place, especially when the abscess formation is slow, it may be confounded with hydronephrosis, pyonephrosis, or hydatid cysts; but, on careful analysis of the symptoms, these affections are soon, one by one, excluded from further consideration. These three affections are to be excluded when the phlegmasic process is characterized by œdema of the integuments, a deep, doughy sensation on palpation, tenderness on pressure, and acute pain. In hydronephrosis and hydatid cysts there occur neither rigors nor febrile reaction. In any doubtful case an exploratory puncture or incision is indicated, and this generally establishes the diagnosis.

Two other morbid conditions are sometimes confounded with perinephric abscess—caries of the vertebræ and coxitis—and this error has led to special treatment for these affections until the abscess has pointed in the lumbar region and has been relieved by incision, when all the signs of vertebral or hip disease have vanished.

In the case of a small perinephric abscess the diagnosis is uncertain, and the exploratory incision by which it may be established is warranted only by symptoms such as frequently recurring rigors and continuous deep-seated lumbar pain.

In the treatment of perinephritis the first indication is to strive to effect resolution; this failing and suppuration ensuing, the second indication is to promptly give exit to the pus, and the third indication is to endeavor to thoroughly disinfect the abscess cavity.

Even if there is a doubt as to the existence of perinephritis, the symptoms of phlegmasia in the lumbar region warrant a vigorous antiphlogistic treatment, which should be instituted as soon as the first symptoms are manifested. For this end, six or eight wet cups or a dozen leeches should be applied to the loin on the affected side. The cupping or leeching should be followed by hot fomentations for two or three days. The existing constipation should be relieved by a cathartic, and the catharsis kept up by salines. Anodynes should be given in sufficient doses to relieve pain and insure sleep. On the third or fourth day blistering, produced by vesicating collodion, may be resorted to with advantage. The blistered spaces need not be over two inches in diameter, but this blistering should be repeated every second day, each time on a different spot, and allowed to dry up without suppuration. During the blistering, which may be continued for two weeks, the fomentations should be replaced by a thick layer of dry absorbent cotton. If, during this time, the pain, tenderness, and swelling perceptibly diminish, this subsidence indicates that resolution is going on, and the process may then be promoted by inunction of the ilio-costal space twice daily with a salve composed of one ounce of belladonna ointment, one ounce of simple cerate, and two drachms of potassic iodide, the whole region to be covered with absorbent cotton. The diet should be simple but nourishing, and the strength of the patient maintained, if necessary, by the free exhibition of alcoholic stimulants.

The antiphlogistic treatment, if it is to be successful, should produce the most marked modification of the phlegmasic process during the first few days; otherwise if, in the course of ten or twelve days, there should be much febrile reaction, increased and increasing tumefaction with œdema of the integuments, whether or not fluctuation is detected, it is almost certain that suppuration has begun. Then, without delay or hesitation, a free incision should be made in the lumbar region corresponding to the anterior border of the quadratus lumborum muscle, and the dissection carried through the aponeurosis of the flat abdominal muscles close to the border of the quadratus, meanwhile securing all bleeding vessels until the abscess wall is reached and freely incised. The index finger is then introduced before the abscess is emptied, and the nature of the perinephritis ascertained. If a free calculus is detected, it should be extracted without delay. But if only a part of a calculus projects into the abscess cavity, the knife or the thermo-cautery is necessary to enlarge the opening through which it projects from the kidney, and great caution should be observed in its extraction, which is effected by lithotomy forceps. Sloughs of connective tissue may be loosened with the finger and extracted with dressing forceps.

The third indication, the disinfection of the abscess cavity, is effected by means of the ordinary irrigating apparatus used by surgeons. The irrigation should be begun with a warm solution of mercuric chloride (1 to 10,000) and five per cent. of peroxide of hydrogen. After using three or four pints of this solution, its strength may be increased to 1 to 5,000 and ten per cent. of peroxide of hydrogen. The irrigation should be continued until the escaping fluid is clear and entirely free from pus. A large drainage-tube should then be introduced, and the wound stitched and suitably dressed.

Under favorable circumstances the abscess cavity is soon obliterated and the external wound healed. It is, however, wise to keep the drainage-tube in position for ten days or two weeks, irrigating once a day, even if no more pus should flow. The brevity of the convalescence after this operation is sometimes surprising. In Dr. Smith's case there was no suppuration after the disinfection of the abscess cavity, and the patient was well in twenty-five days.

In some cases of consecutive perinephric abscess it is not wise to encourage early closure of the wound, and an ample drainage-tube should be kept in position and shortened from time to time until the cavity is obliterated.

V.

CYSTITIS; ITS CAUSES, SYMPTOMS, PROGRESS, ANATOMICAL CHARACTERS, DIAGNOSIS, AND PROGNOSIS.

URO-CYSTITIS—phlegmasia of the urinary bladder—is most frequently confined to its mucous membrane—myxo-cystitis; sometimes it invades the submucous fibrous coat and the muscular coat—interstitial cystitis; and rarely reaches the peripheral connective tissue and peritoneal covering—pericystitis. Some of the writers of the last century regarded cystitis as a phlegmasia of all the coats of the bladder. When the phlegmasia was confined to the mucous coat they termed the affection catarrhal fluxion of the bladder, or catarrh of the bladder. Later the term catarrhal cystitis was adopted to signify phlegmasia of the vesical mucous membrane, supposed to be attended with a great flow of mucus.

CAUSES.—This phlegmasia, which occurs with great frequency at nearly all periods of life, is consecutive to renal, urethral, or prostatic affections, and to injuries and other local irritants. Its causes may therefore be arranged into the following four groups, and each group into sundry species and varieties of causes: 1. Cystitis arising from deviations in quantity or quality of the urinary secretion. 2. Cystitis arising from the extension of phlegmasic action of neighboring organs. 3. Cystitis arising from injuries of the bladder and from other local irritants. 4. Cystitis arising from stagnation and fermentation of urine due to obstructed urination.

1. *Cystitis arising from Deviations in Quantity or Quality of the Urinary Secretion.*—Any marked deviation from the normal standard of quantity or quality of the urinary secretion is liable to cause cystitis. When there is much increase in quantity—polyuria—dependent upon disturbed innervation or structural disease of the kidneys, this urine of very low specific gravity rapidly distends the bladder, whose epithelium becomes water-logged, its superficial stratum is cast away, and the irritant urine induces in the capillaries of the mucous membrane a sufficient degree of congestion to permit the emigration of great numbers of leucocytes, which, reaching the surface and dying, become pus. If the urine be examined microscopically during the early days of an excessive and persistent polyuria, it will be observed that quantities of vesical epithelial cells have been washed away by the great flood of pale urine and much swollen by endosmosis. Examined later, it is found that these epithelial cells are much exceeded in numbers by pus-corpuscles, and that the urine contains also some red blood-cells.

When the urine is decreased in quantity—oliguria—its specific gravity is increased from excess of solid matter. It is thereby rendered acrid and irritating to the mucous membrane, and soon causes cystitis. Certain poisons induce oliguria when taken for a long time, notably opium. To what extent those who make inordinate use of this drug suffer from vesical irritability is worthy of particular inquiry on the part of the physicians who have charge of such patients.

Congestion of the vesical mucous membrane from any cause renders this membrane vulnerable even by normal urine. One of the causes of vesical congestion deserving more consideration than it generally receives is disturbance of the cutaneous circulation. This disturbance arises from different diseases, and also from certain injuries of the skin.

Paludal fevers, with frequently recurring rigors, and the so-called congestive fever, are attended with oligæmia of the body surface and consequent congestion of the internal organs and of the mucous membranes. The kidneys at first secrete scantily, and the urine, overcharged with solid matter, irritates the congested bladder. Sychnuresis is the immediate result. Later the secretion greatly increases and washes away much of the bladder epithelium. The urine soon becomes turbid from the presence of pus and of saline precipitates. There is then a subacute general myxo-cystitis, which, however, ceases soon after the removal of the original cause.

Any extensive laceration or ablation of the cutaneous surface causes shock, rigors, and internal congestion. The urine, at first scanty, soon increases in quantity and constitutes the irritant exciting cause of the cystitis.

Extensive burns of the skin also constitute an indirect cause of cystitis. From the examination of statements made by Dupuytren, Nélaton, Legouest, and others, and from the observation of cases in Bellevue Hospital, it seems that extensive burns of the surface of the body have often been the indirect cause of cystitis. But to ascertain the proportion of cases of cystitis caused by burns would require extended investigation. Theoretical reasons, clinical observation, and necropsic evidence have been furnished by careful investigators, from the time of Dupuytren, to explain the mechanism of the cystitis thus indirectly caused. The earliest phenomena noted of extensive burns of the body, irrespective of degree, are shock, rigors followed by febrile reaction, inordinate thirst, frequent desire to urinate, and congestion of the mucous membranes. These phenomena, and especially the congestion, are accounted for partly by the sudden disturbance of the nervous system and of the cutaneous circulation. Granting the occurrence of congestion of the vesical mucous membrane, then normal urine, even in small quantity, is sufficiently irritating to this congested membrane to cause at first frequent and urgent urination and, later, cystitis. Impairment of the function of the great gland, the skin, such as results from extensive burns, is apt, in a short time, to impose much additional work of elimination upon the kidneys, and the resulting polyuria aggravates the beginning cystitis induced by the first irritant, which may have been a urine diminished in quantity, but surcharged with solid matter, or even normal urine in quantity and quality.

Exposure to humid cold is spoken of by many authors as a cause of cystitis, doubtless with clinical foundation, but generally with no explanation as to how and why humid cold produces this effect upon the bladder. Exposure to humid cold is sometimes the indirect cause of cystitis because, like paludal and congestive fevers, it causes primarily some disturbance of the cutaneous circulation leading to congestion of the vesical mucous membrane and rendering it vulnerable by the urine which is the excitant of the cystitis.

The effect upon the vesical mucous membrane of variations in the quality of the urine also requires some notice. Persistent hyperlithuria, so common among dyspeptics, is a very frequent cause of cystitis. Highly acid urine, whether increased or decreased in quantity but containing an excess of uric acid, mechanically irritates the bladder and excites phlegmasia of a greater or less extent of its mucous membrane, beginning generally at or near the urethro-vesical orifice, which is pricked at each act of urination by the almost innumerable sharp-pointed crystals. Some of the most distressing cases of cystitis begin in this way. Persistent oxaluria, by the same mechanism, causes trachelocystitis. Alkaline urine, as will be seen later, likewise causes cystitis.

Pyuria from chronic pyelitis also gives rise to cystitis of the lower fundus, partly from fermentation and the irritating action of carbonate of ammonium evolved from the fermentative process.

Glycosuria is another cause of cystitis which is not infrequently overlooked. In cases of excessive glycosuria, with or without polyuria, saccharine fermentation is liable to occur and cause very distressing cystitis.

Cantharidine, taken internally or absorbed by the skin from Spanish-fly blisters and eliminated by the kidneys, is a powerful irritant to the vesical mucous membrane and causes trachelocystitis with very painful stranguria. The French, who sometimes use the resin of thapsia as a counter-irritant, think that its absorption and elimination by the kidneys produce effects similar to those of cantharidine.

Turpentine causes cystitis, either when taken internally in poisonous doses, or through gradual saturation of the system by inhalation of its fumes, as occurs among workmen in varnish factories or among sailors on "turpentine ships," some of the men being attacked with nephritis, trachelocystitis, and even urethritis, attended sometimes with profuse hæmaturia.

Excesses in alcohol, new beer, and cider-drinking are often potent factors in the causation of cystitis.

Ether, when inhaled during one or two hours for anæsthetic purposes, being largely eliminated by the kidneys, induces at first oliguria, then polyuria. In cases of prolonged anæsthesia perfect consciousness is not ordinarily restored for three or four hours after cessation of the ether inhalation. Sensation remains blunted and the mind somewhat cloudy for some time after this, so that any discomfort caused by urinary accumulation in the bladder is vaguely attributed either to the region of the late operation or to some distant part of the body. Unless particular inquiry or an examination is made, the bladder becomes so overdistended in the course of twelve hours that the patient can not urinate at will. This overdistention, together with the congestion induced by the irritant ether, causes a cystitis which often persists many weeks and sometimes becomes chronic. This cystitis is not an uncommon accident of many surgical operations necessitating prolonged anæsthesia.

Careful inquiry into possible ætical factors serves to eliminate cases of so-called idiopathic cystitis.

2. *Cystitis arising from the Extension of Phlegmasic Action of Neighboring Organs.*—Trachelocystitis is sometimes caused by, or rather, as Fournier says, may be a phase of, urethritis, a result of the extension of the phlegmasia to the urethro-vesical orifice on or about the third week of the urethritis. Though believing that, in the majority of cases, it comes without provocation, he acknowledges that trachelocystitis may, during urethritis, be excited by sexual intercourse, alcoholic excesses, irritating injections, catheterism, etc.

Trachelocystitis is sometimes excited by gonecystitis, prostatitis, hæmorrhoids, proctitis, etc.

3. *Cystitis arising from Injuries of the Bladder and from other Local Irritants.*—Unduly frequent catheterism sometimes does violence to the epithelium at the urethro-vesical orifice, and thus causes subacute or acute trachelocystitis, and is liable, in the same way, to cause general myxocystitis, more particularly when unclean instruments are used. Violent catheterism causes cystitis by contusing or by tearing the neck or body of the bladder. Contusions or wounds of the bladder directly cause cystitis, and also in-

directly by leaving behind some foreign body as the irritant, such as a clot of blood, a bullet, a scale of bone, a piece of the clothing of the wounded person, etc.

Among the irritants known to cause cystitis are calculi, foreign bodies, entozoa, new growths, and tuberculosis. No comments need be made at present upon these causative agents, except in the case of the entrance into the bladder of some of the foreign substances that reach it from the small and large intestines and from without. Knuckles of small intestine sometimes become adherent to the peritoneal coat of the bladder and, by ulceration, allow the intrusion of different substances besides a part of their contents into the vesical cavity. Thus needles, fish-bones, seeds, and other objects pass from the intestines into the bladder and give rise to cystitis. In a dissecting-room specimen it was discovered that three knuckles of the ileum had become firmly adherent to the upper part of the bladder, and that between each of these knuckles and the bladder there was an opening, nearly circular, with smooth edges, and about half an inch in diameter. Judging from the appearance of the parts, the ulcerations had probably occurred several months before death. It was also evident that the existing cystitis was caused by the constant passage of the intestinal contents into the bladder. In a case of iliac abscess from ulceration of the appendix vermiformis, occurring in a boy, the tumefaction suddenly subsided, and the patient's urine was found to contain fæcal matter. The consequent cystitis did not last very long, and the boy made a good recovery. There are many cases on record where fæces and different foreign bodies had passed from the rectum into the bladder to cause cystitis and become the nuclei of phosphatic stones.

The prolonged retention of catheters for drainage of the bladder, broken ends of catheters, and other foreign bodies introduced from without are among the many factors in the causation of cystitis.

4. *Cystitis arising from Stagnation and Fermentation of Urine due to Obstructed Urination.*—The first effect of obstructed urination, whether from urethral stenosis, prostatic obstruction, or urethro-vesical contracture, is a series of spasmodic contractions of the bladder which is thus incessantly wrestling with the obstacle to the expulsion of the urine. If this be not artificially relieved, the struggle continues week after week and month after month. During that time the stream of urine steadily diminishes in size and force, and the bladder does not completely empty itself. The stagnant urine soon undergoes fermentation, followed by the evolution of carbonate of ammonium, which is a potent factor in the production of the cystitis.

Some diseases and injuries of the brain or spinal cord are followed by retention of urine, said to be due to paralysis of the bladder. If complete paralysis of the bladder occurs it seems as though there should be incontinence and not retention of urine. In cases of disease or injury of the nervous centers, is not the retention of urine due to impaired sensation in the bladder, which then allows the urine to accumulate and distend it, the disease or injury of these nervous centers interfering with their reception of the impression of the need to urinate? Carefully observed cases seem to indicate that some lesions of the nervous centers which disturb the action of the bladder do not cause complete paralysis of that viscus, for closure of the urethrovesical orifice is not interfered with, but its voluntary opening is impossible, owing to loss of the sensibility which is so necessary to express the need to urinate. The pathic conditions which result from this loss of sensibility are contracture of the urethro-vesical orifice, stagnation and fermentation of the urine, and cystitis. In a number of autopsies made at Bellevue Hospital, upon cases of fracture of the spine with paraplegia, the bladder was almost invariably found inflamed, dilated, and sometimes thickened. In some cases surviving the injury several months, phosphatic calculi were found in the bladder and in the renal pelves.

The four groups of ætical factors give rise to acute, subacute, and chronic cystitis. The symptoms of each of these three types of cystitis will next be examined.

THE SYMPTOMS of cystitis vary according to the particular site, cause, severity, and stage of the phlegmasia, but the several types of cystitis present some symptoms that are common to all of them. These are disturbances in urination, pain, and deviations from the normal characters of the urine.

The earliest local symptom of acute cystitis, whether of the body, lower fundus, or neck of the bladder, is unduly frequent urination. This is soon followed by spasm of the muscular coat excited by irritation of the congested mucous membrane; the urine intensifying this irritation may be decreased or increased in quantity, and may be of high or of low specific gravity. During the period of increase of trachelocystitis the urine is passed in short interrupted spurts, often in drops, with the greatest distress, and in some cases more than a hundred times in the twenty-four hours. At times urination is irrepressible, and the garments are soiled with urine. In rare instances there is retention of urine. These anomalies of urination are due partly to swelling at the urethro-vesical orifice and partly to spasm of the whole bladder. The pain during urination extends to the distal extremity of the urethra in chronic as well as in subacute and acute trachelocystitis, but is most intense in the acute type, when it is characterized by patients as scalding, burning; reaching its maximum of intensity during the expulsion of the last drops of urine, and is associated with rectal tenesmus and sometimes irrepressible defecation.

In cases of vesical injury, stone, foreign bodies, and retention of urine, there is pain in the bladder independent of urination, and this pain is often irradiated to the abdominal organs, to the lumbar region, and along the nerves of the lower extremities, and is much intensified by sudden movements of the body. In cystitis of the neck and lower fundus the pain is aggravated by accumulation of fæces or by any other source of compression in the rectum. When the body of the bladder is implicated, the slightest pressure applied to the hypogastric region gives very much pain.

The deviations from the normal characters of the urine in acute cystitis are increase of acidity, excess of uric acid, and the presence of pus and blood in greater or less quantity. In trachelocystitis, attended with strangury, the small quantity of urine voided each time is mixed with blood and pus, and with mucus derived from the urethro-vesical region, the prostate, and the glands of the urethra. In cystitis due to stagnation of urine there is an abundant precipitate of ammonio-magnesian phosphates, and the urine is alkaline, slimy, highly purulent, and contains much exfoliated vesical epithelium.

The symptoms of chronic cystitis without obstruction of urination are of the same kind, but of lesser degree than those of acute cystitis, the presence in the urine of more or less pus and exfoliated vesical epithelium being among its essential characters.

The symptoms of chronic cystitis due to prostatic or urethral obstruction are frequent, difficult, and painful urination; the small stream of alkaline, purulent urine being often interrupted, and the act of urination failing to relieve the bladder, which may be distended. This type of cystitis is accompanied by a dull, constant pain along the ureters, extending up to the kidneys. The patients complain of lumbago and sciatica, and often seek the physician's advice for these aches rather than on account of the urinary stagnation and cystitis.

The constitutional symptoms of cystitis vary with the intensity of the phlegmasia and also with its cause. In acute trachelocystitis due to the extension of urethritis the pain is rarely such as to cause much general disturbance, and there is no febrile reaction, no inconvenience except during urination. It is only when urination is very frequent—every ten minutes—and accompanied with tenesmus, that the patient complains of being much ill at ease, for he is deprived of sleep, is feverish at night, and loathes his food; but these symptoms are at their height during the period of increase, which rarely lasts longer than three or four days.

In trachelocystitis due to the action of cantharidine the constitutional symptoms are proportionate in degree to the amount of the poison absorbed. In moderate quantity, the poison causes only such general effects as are induced by pain and want of rest; but when the quantity of cantharidine is great, as when administered by the ignorant or by others with nefarious intent, the constitutional effects are often alarming and sometimes fatal.

Superacute cystitis involving nearly if not all the tunics of the bladder is attended with very grave symptoms, such as recurring rigors, constant fever, vomiting, general depression, and signs of purulent infection or of intercurrent peritonitis.

When retention of urine occurs either in acute or in chronic cystitis and the bladder becomes much overdistended, the constitutional symptoms are of the gravest order and often point to a fatal issue.

THE PROGRESS of cystitis corresponds in a great measure with its cause and type, with the previous condition of the bladder, and with the age, constitutional peculiarities, and general health of the patient.

Cystitis arising from deviations in quantity and quality of the urinary secretion continues as long as the exciting agent is operative, often long after it is removed, and sometimes becomes chronic. In those cases arising indirectly from disturbance of the cutaneous circulation the cystitis has been observed to resolve in a few days, but occasionally it passes through its several stages and lasts many weeks or months. The following case is given as an example of the ordinary course of cystitis caused indirectly by an extensive burn. In this case the polyuria, though not extreme, seems to have lasted longer than it should, as it continued several weeks after the greater part of the burned skin had healed.

A man, twenty-seven years of age, was admitted into Bellevue Hospital on the 23d of May, 1891, three hours after he had been burned in the face, thorax, epigastrium, and upper extremities. The accident happened while he was varnishing with shellac and alcohol the interior of a beer vat; the safety lamp used for illumination having exploded, set the varnish on fire, and before he could get out of the vat his clothing and the several parts of his body just mentioned were burned. Though the burns were very extensive, affecting about one fourth of the body surface, they were not all equally deep, and ranged from the second to the fourth degree. In a few places only did they reach the fourth degree, while in the greater part of the injured skin of the face and body the burns did not exceed the second degree. At one o'clock P. M. on the day of his admission the thermometer showed his body temperature to be 101°; his respiration was then 24 a minute, and his pulse 110. At nine o'clock P. M. his temperature had risen to 104°. His respiration was 18 and his pulse 140. Afterward there were fluctuations between 104° and 100° in his temperature, which did not become normal until the 18th of June, when all the more superficial burns were healed. The pulse had then fallen to 72 a minute. The respirations for several days fluctuated between 18 and 22 a minute. On the first day of the accident he had great thirst and an almost incessant desire to urinate. On the second and third days he urinated every five and ten minutes and the urine was dark and scanty. For the following four days the intervals of urination increased gradually to fifteen minutes, half, three quarters, and finally one hour. The urine had then become turbid. Polyuria began on the seventh day after the accident. Before this accident he was in the habit of urinating only three or four times a day. From the 2d of June a faithful record was kept of each act of urination and of the quantity of urine passed. This record shows that he urinated fourteen times in the first twenty-four hours, ten days after the accident, passing in all seventy-one ounces of urine. The greatest quantity of urine passed by the patient during any twenty-four hours was one hundred and three ounces; this was twenty days after the accident; and the smallest quantity was fifty-seven ounces—eleven days after the accident. The greatest quantity passed at any one act of urination was twenty-eight ounces, and the smallest quantity was two ounces. The urine was not examined microscopically until the twelfth day of the accident. It was then found to contain pus. The quantity of pus gradually decreased, though the patient received no local treatment for his cystitis. On June 20th, twenty-eight days after the accident, the urine was found, on microscopical examination, to contain an abundance of octahedral crystals of oxalate of calcium, some vesical epithelium, and a few pus cells. On June 25th the polyuria had decreased to sixty-eight ounces. He continued as an out-patient and was under treatment for the burns of the upper extremities, which were not completely healed in the latter part of August, 1891, the polyuria having decreased but little.

Cystitis due to persistent hyperlithuria deliquesces or resolves very rapidly as soon as a suitable general treatment renders the urine innocuous; but when the hyperlithuria is overlooked, the phlegmasia invades the whole vesical mucous membrane and the submucous connective tissue. Contracture, diminished capacity, and thickening of the bladder ensue, and the patient is much distressed by the very frequent and painful expulsion of purulent and bloody urine, even after the affection has become chronic.

Cystitis due to the action of cantharidine deliquesces in a few hours when the quantity of the poison absorbed is little, otherwise the phlegmasia is more violent and extensive and the urine is purulent for weeks or months.

The progress of trachelocystitis arising from the extension of phlegmasic action of neighboring parts is very rapid when, under suitable treatment, the period of increase is cut short, so that at the end of three or four days urination is less frequent and less painful. The tenesmus ceases, the urine is passed in larger quantity, and is clearer. In such cases resolution is effected in the course of eight or ten days. In severer cases, particularly when treatment is delayed, resolution is not complete under three, four, or six weeks, and in some instances the phlegmasia passes into the chronic state and the whole of the vesical mucous membrane may become involved. Cystitis from injuries of the bladder, and from other mechanical irritants, such as foreign bodies, calculi, etc., continues with greater or less violence until the irritant is removed, and may require very active treatment long afterward. Soon after the ablation of benign new growths the phlegmasia rapidly subsides, but such is not the case with malignant disease and tuberculosis.

Cystitis arising from stagnation of urine due to urethral, urethro-vesical, or prostatic obstruction is gradually and slowly developed, beginning sometimes with the characters of subacute and sometimes with those of chronic phlegmasia.

In the case of obstruction from urethral stenosis, if enlargement of the contracted part of the urethra be effected before the bladder is very seriously damaged, the phlegmasia subsides or even disappears; otherwise ureteric and pyelic ectasia and phlegmasia ensue, and the supervention of complete retention of urine from a debauch *in Baccho et Venere* is to be regarded as a very serious complication.

Similar phenomena arise from neglected urethro-vesical and prostatic obstruction. In the case of unrelieved complete retention of urine from prostatic obstruction the bladder becomes greatly distended and sometimes the upper urinary organs are implicated beyond remedy.

A case seen in consultation in May, 1891, will serve to illustrate the progress of neglected prostatic obstruction and cystitis. The patient, seventy-three years of age, had been suffering for six years from unduly frequent and at times irrepressible urination. He had persistently refused to be catheterized until the last week of his life, and for four months had been greatly harassed by sychnuresis, passing only a few drachms of urine each time. When seen he was extremely emaciated and very feeble. His bladder was much distended, extending up to the umbilicus and projecting forward very much as does the pregnant uterus at the sixth month. It was not deemed prudent to empty this bladder at one sitting, therefore, when ten ounces of urine had been withdrawn, the catheter was removed and not again used until the expiration of three hours, when twelve ounces of clear urine escaped which apparently contained but a small quantity of pus. After this, it was agreed that one pint be drawn off four times each day. Palpation of the abdomen then revealed great ectasia of the left ureter, which was at first mistaken for a knuckle of small intestine. The right ureter could not be felt. Although the bladder was in this manner gradually emptied in the course of three days, and all untoward consequences to the organ that would have arisen from its sudden evacuation were thus averted, the patient gradually sank and died one week after. No autopsy was made. Aside from the effects of the overdistention of his bladder, the patient was in fair general condition, and had he consented to be regularly catheterized, even a few months before the fatal event, he would have been spared great suffering and would not have died from the consequences of retention of urine.

Another grave consequence of retention of urine may here be incidentally stated, and that is the profuse hæmorrhage which sometimes follows the too precipitate evacuation of the overdistended bladder in elderly men suffering from prostatic obstruction and cystitis. This phenomenon may be thus explained: In overdistention of the bladder its coats are greatly stretched; the capillary vessels of the mucous membrane are likewise stretched and consequently weakened. When, therefore, the mechanical support given by the accumulated urine is suddenly removed, the extreme tension of the vesical parietes is succeeded by extreme flaccidity; the nearly empty capillaries are almost instantly gorged with blood, and their delicate walls give way before the sudden impulse of the refluent blood which soon begins to ooze from thousands of minute rents of the mucous membrane. In some cases the bladder has been found greatly distended with clotted blood.

Polyuria sometimes follows the precipitate evacuation of the distended bladder. It has been observed in several instances in great excess. In one case it reached twenty-seven pints (four hundred and thirty-two ounces) in twenty-seven consecutive hours. From this it gradually decreased to ninety-six ounces each day. In three months the amount of urine in the twenty-four hours was not below sixty-four ounces, and a year expired before it dropped to forty-eight ounces in the twenty-four hours. This is an extreme case; but polyuria to a hundred ounces is not uncommon in these cases, particularly when there coexists either renal sclerosis or hydronephrosis.

In the case of stagnation of urine from disease or injury of the nervous centers, as well as from urethral or prostatic obstruction, unless catheterism be regularly employed, the phlegmasia progresses from bad to worse until the upper urinary organs are implicated. There is in these cases a constant liability to calculous formation in the bladder and renal pelves.

NORMAL APPEARANCES OF THE BLADDER.—In studying the patho-anatomy of cystitis, the normal appearances of the bladder should be borne in mind, particularly the thickness of its walls and the color of its mucous membrane.

The bladder walls consist of five coats—four complete and one incomplete. The external or peritoneal, the thinnest of the coats, is incomplete, covering the posterior surface, the whole of the upper fundus, a small extent of the lateral surfaces, and a variable extent of the lower fundus. Next to the peritoneal coat is a fibrous coat, which is continuous with the subperitoneal connective tissue and envelops the whole bladder. Beneath this is the muscular coat in three superposed layers of smooth muscle tissue; the external layer is longitudinal, the middle layer is transverse, and the internal layer is reticular. This internal reticular layer is separated from the mucous coat by the submucous or fourth coat, which is made up of loose connective tissue with a rich plexus of veins. The fifth is the mucous coat, the mucous membrane of the bladder, surmounted by a polymorphous epithelium. The mucous is the thinnest of the complete coats and contains no mucous follicles.

The maximum thickness of the walls of the empty normal adult bladder is about a quarter of an inch; but when the organ is in a state of moderate distention it is about an eighth of an inch.

When the bladder is in a state of plenitude its mucous membrane is smooth; but when it is in a state of vacuity the mucous membrane is rugous, except at the trigone, where it retains its smoothness during contraction of the bladder.

The color of the vesical mucous membrane, viewed after death, is nearly white in young children, it is grayish-white in adolescents and adults, and pinkish in old men. Viewed during life with the cystoscope, in adults it is of a distinctly pink hue, with here and there small arborescent blood-vessels.

The most sensitive part of the vesical mucous membrane is that which covers the trigone, particularly its anterior extremity, corresponding to the urethro-vesical orifice.

THE ANATOMICAL CHARACTERS OF CYSTITIS vary with the site, type, stage, and termination of the phlegmasia.

In acute trachelocystitis the mucous membrane is of a deep-red color, highly congested, swollen, velvety, and sometimes softened and even granular.

When cystitis arises from friction by a calculus, it begins at the neck and trigone of the bladder. As the calculus increases in size, the phlegmasia extends to the whole of the lower fundus, which becomes coated with a layer of pus and exfoliated epithelium. The mucous membrane is sometimes ulcerated at one or several spots when the stone is irregular in shape and rough. The same changes occur from the irritation of uneven foreign bodies.

Ulceration and even perforation of the bladder coats have arisen from the prolonged retention of a catheter, death occurring from the entrance of urine into the peritoneal cavity. This is well illustrated in the exhibited specimens.

The irritant, whatever it may be, remaining undisturbed, the phlegmasia sometimes extends to the submucous coat, where small abscesses form and discharge their contents into the bladder cavity, or increase in size and point inferiorly toward the rectum, anteriorly toward the pubes, or laterally or posteriorly toward the peritonæum.

In most cases the constant spasmodic contractions of the bladder to expel its contents lead to increase of thickness of the muscular coat and the phlegmasia to sclerosis of the submucous and subperitoneal coats and to permanent contracture of the viscus. In these cases the reticular or internal layer of the muscular coat is sometimes much thickened, so that the surface of the bladder cavity is very irregular, rising into bold columns and bands, resembling those of the heart cavities; hence their name, columnar bladders. In the spaces between large columns the mucous and submucous coats are forced and form small diverticula capable of lodging small calculi or of retaining from a few drops to a drachm of urine. The thin walls of these diverticula sometimes ulcerate and allow their contents to escape into the ambient connective tissue, causing pericystitis, or into the peritoneal cavity. These "spontaneous perforations" of the bladder were first well described in 1835 by the late Dr. Mercier, of Paris. In much rarer instances the diverticula are fewer, but are large and constitute what is known as sacculation of the bladder. This will be described under the head of ectatic affections.

Columnar bladders exist mainly in cases of chronic cystitis from obstruction to urination.

The slimy urine drawn from the bladder in chronic cystitis has led to the erroneous designation of this affection as "catarrhal fluxion, or catarrh of the bladder," both terms having been used first by Lieutaud in the eighteenth century. The term catarrh of the bladder is misleading and tends to error in diagnosis and to consequent neglect of regular evacuative catheterism of the bladder. Slimy, purulent urine is the result of fermentation and the conversion of the urea in the urine into ammonium carbonate, which possesses the property of rendering pus slimy, and fermentation occurs when the urine is retained in the bladder by a material obstacle at the urethro-vesical orifice or in the urethra. The ammonia is not only the irritant cause of the suppuration, but the active agent in the conversion of the greater part of the pus into slime. Many writers still specialize "catarrh of the bladder" from chronic cystitis. It is known that chronic cystitis does often exist without the urine being rendered slimy, but in such cases there is no hindrance to urination, no stagnation, no fermentation, no ammonia, and consequently no slime. The slimy urine of so-called "catarrh of the bladder" probably contains very little mucus. That the slime is due to the action of ammonia upon pus is demonstrable by taking pus from an abscess, diluting it with water in a test-tube, and adding liquor ammoniæ. In a few moments the fluid becomes slimy and can only be distinguished from slimy urine by its color and by its not containing the elements of the urine.

Among the illustrative specimens exhibited are some bladders whose walls have increased to three quarters of an inch or more in thickness. These specimens were taken from the bodies of men that had died after long suffering from urinary obstruction, stagnation of urine, and consequent cystitis and pyelonephritis. They are nearly all good examples of interstitial cystitis superadded to myxocystitis. In most of these cases the bladder is capacious. In a few specimens the bladder is shriveled and reduced in capacity to two ounces or even to an ounce and a half. Yet both the large and small illustrate vesical contracture, neither being able to expel any urine. In nearly all the specimens the mucous membrane was thickened, red, and its vessels were gorged with blood. In some of them this mucous membrane was of a slaty hue. In one it was mammillated, œdematous. These bladders contained a slimy, purulent, chocolate-colored, alkaline, fœtid urine. In nearly all of them the ureters and renal pelves were distended by this offensive urine. In some specimens the mucous membrane was coated with slabs of thick, adhesive pus, miscalled false membranes and diphtheritic membranes. One of these specimens showed, in its fresh state, the whole trigone covered with a thick layer of this pus, and in many spots the mucous membrane, of a dark-red color, appeared where the softer parts of the layer of pus had been washed away by a stream of water. The bladder walls are three quarters of an inch in thickness, and the ureters and renal pelves are much dilated. These pathic states resulted from a long-neglected urethral stricture. In two specimens nearly the whole of the vesical mucous membrane seems to have been destroyed by tuberculosis which also affected both kidneys.

Gangrene of the mucous membrane of the bladder is a rare occurrence even from violence. It has happened from the supervention of acute or superacute phlegmasia in cases of chronic cystitis, from unrelieved complete retention in cases of stagnation of urine, and from injury, particularly in bladders containing very large calculi.

THE DIAGNOSIS of cystitis is arrived at after ascertaining not only the existence of this phlegmasia, but its cause, site, type, stage, and complications. Frequent desire to urinate and pain are common to all types and stages of cystitis, and vary only in degree. These two symptoms together suffice to establish the existence of cystitis. To ascertain the cause of a particular attack of cystitis is sometimes very difficult and requires much cross-examination and a careful analysis of the facts elicited from the patient. No further reference will now be made to the question of ætiology, as it has already been fully discussed.

Acute trachelocystitis is known to exist when urination becomes very frequent, painful, and at times irrepressible; the urine, passed in small quantities, even in drops, being mixed with blood in greater or less proportion, especially during the emission of the last drops, when the pain is at its height; this urine at first containing a considerable proportion of mucus, derived from the follicles of the urethra, and in two or three days some pus, except in trachelocystitis due to the extension of acute urethritis, when pus is present in the urine from the beginning of the attack. Trachelocystitis is a common complication of prostatitis and of gonecystitis, while prostatitis and gonecystitis are rare complications of trachelocystitis. Rectal exploration with the finger is therefore necessary to ascertain the existence or non-existence of prostatitis or of gonecystitis in any case of trachelocystitis.

Subacute trachelocystitis is known to exist by manifestations which are similar to, but of lesser degree than, those of the acute type. The introduction of a rectangular exploring sound is necessary to determine if this phlegmasia is the outcome of a vesical calculus or of the presence of a foreign body.

Chronic trachelocystitis is usually associated with chronic prostatitis and sometimes with chronic urethritis. The question of its diagnosis will be examined in connection with chronic prostatitis and with chronic urethritis.

The diagnosis of subacute general myxocystitis, provoked by deviations from the normal standard of quantity and quality of the urinary secretion, is arrived at through the history of the affection and through microscopical examination of the urine. When this type of cystitis becomes chronic and is attended with frequent and painful urination, the whole bladder is contractured and its capacity diminished. This is ascertained by the slow injection, through a soft catheter, of a warm antiseptic solution, the quantity of fluid tolerated indicating the capacity of the diseased bladder. In some cases the bladder capacity is reduced to four, three, two ounces, or even to one ounce. This, however, is not the only type of cystitis in which contracture with diminished capacity of the bladder occurs. Such an untoward complication may arise in cystitis due to nearly all the causes previously named, and is therefore to be taken into consideration in diagnosticating cystitis generally.

The diagnosis of chronic cystitis developed in consequence of obstructed urination requires mechanical exploration of the urethra, urethro-vesical orifice, or prostate, and microscopical examination of the urine. If the obstruction be due to a urethral stricture, it is revealed by the use of the bulbous bougie. If urethro-vesical or prostatic obstruction be the cause of the stagnation of urine, the rectangular sound demonstrates the existence of either; also the degree of induration of the bladder and of enlargement of the bands of muscle tissue of the reticular layer. Gross inspection shows the urine to be glairy, slimy, and this urine converts red litmus paper to blue. Microscopical examination of the urine brings into view innumerable crystals of the ammonio-magnesian phosphates, pus-cells, and vesical epithelium. When no urethral, urethro-vesical, or prostatic obstruction exists and the urine contains creamy pus and no slime, the origin of the pus is presumably pyelic, urethritis being, of course, excluded.

Cystitis, general or local, arising from calculi, from injuries, or from the lodgment of foreign bodies, requires for its diagnosis mechanical exploration of the bladder and microscopical examination of the urine.

When retention of urine complicates the acute or the subacute type of cystitis, the severe pain seated in the hypogastric region and irradiated to the abdominal and lumbar regions, the tenderness and tensive swelling in the hypogastric region, the straining during vain efforts to urinate, the flatness under percussion in the region of the distended bladder, render the diagnosis of this complication comparatively easy.

When complete retention occurs in chronic cystitis due to stagnation of urine, some of these symptoms are ill-defined, while others of a graver nature are manifested. For instance, the pain is dull but continuous, there is less tenderness and little or no tension in the hypogastric region, though the bladder may contain much more urine than in the case of retention from acute cystitis, and may project forward like a gravid uterus. Retention of urine in the acute cystitis of youth and middle life is sudden and causes great suffering; in chronic cystitis from prostatic obstruction it is gradual and sometimes undiscovered until the lower part of the abdomen begins to project and a sense of fullness is experienced in that region and in the rectum. In long-neglected cases the patients are feeble and emaciated, able to take but little food, which is often vomited, the pulse is small and weak, slight rigors recur every night, the body is covered with cold sweat having a urinous odor, and, in point of fact, the kidneys are more or less damaged by the action of a column of purulent urine which is retained in and distends the ureter and renal pelvis on either side.

THE PROGNOSIS of cystitis is founded upon its cause, type, and complications, upon the previous condition of the bladder, upon the age, constitutional peculiarities, and general health of the patient, and upon the degree of efficiency of the treatment.

The prognosis is favorable in cases of cystitis arising from the first, second, and third groups of causes, when free from complications and attacking healthy adults; otherwise it is doubtful, or even unfavorable, for the phlegmasia may become unmanageable, may invade the upper urinary organs, and prove fatal in a few weeks, or even in a few days. This is sometimes the case when acute or superacute phlegmasia attacks a bladder that has long been diseased, as in the chronic cystitis from urethral or prostatic obstruction.

The prognosis is unfavorable in cases of long-neglected cystitis with contracture and diminished capacity of the bladder, particularly in old and feeble men. Younger subjects, free from urethral obstruction, withstand the incidental suffering much longer, and their condition is sometimes greatly improved by treatment. In some of these younger subjects it is possible to restore the normal capacity of the bladder even after the lapse of a year from the beginning of the affection, but not without the greatest patience and persistence on the part of the physician and the greatest endurance and determination on the part of the patient.

The prognosis is unfavorable in cases of cystitis due to grave disease or injury of the nervous centers. The patients are made comparatively comfortable and life may be prolonged by treatment, but the cystitis is never cured, and renal complications finally arise, soon to prove fatal.

The prognosis is more favorable in cases of cystitis due to prostatic obstruction in vigorous elderly men, provided they be subjected to regular catheterism and vesical irrigations that tend to arrest fermentation of urine. The life of such patients is not materially shortened by this incurable affection if the local treatment be faithfully carried out.

The conclusions drawn from the foregoing study of the nature, causes, types, complications, and consequences of urocystitis are:

1. This affection can not be dealt with as a single pathic entity.

2. Its various phases and the general condition and age of the sufferer are all to be taken into account before any plan of treatment can be formed.

3. During the treatment circumstances are likely to arise which may render imperative divers modifications in this treatment, or its temporary suspension, or even the substitution of palliative for curative treatment.

VI.

CYSTITIS; ITS TREATMENT.

THE treatment of sufferers from cystitis should be constitutional and local. The general indications are to remove the original cause, to relieve pain, to shorten the period of resolution of the phlegmasia, and to prevent or to combat complications. The special indications vary in accordance with the exigencies of individual cases. The prime requisite to the rational management of a particular case of cystitis is the proper interpretation of its phenomena. This is possible only after the history of the patient is known and the cause of the phlegmasia ascertained, and a close analysis is made of its subjective and objective symptoms. An accurate diagnosis can have no other foundation.

CONSTITUTIONAL TREATMENT.—When a subacute cystitis is traced to supersecretion of urine of low specific gravity, the cause of the polyuria is first ascertained and, if possible, removed; then the cystitis is likely to cease. For instance, when polyuria is due to temporarily disturbed innervation, the re-establishment of the nervous equilibrium is sufficient to effect the cessation of polyuria and thus to remove the cause of the cystitis. This, however, is hopeless in some cases of grave disease or injury of nervous centers, as it is in certain serious lesions of the kidneys where the polyuria is irremediable. In some cases of cystitis due to persistent polyuria, opium in moderate doses has the double effect of relieving pain and of lessening the urinary secretion. In other cases it becomes necessary to add to the opium either ergot extract or gallic acid.

In cases of cystitis caused by diminished secretion, the urine being of high specific gravity and acrid, the treatment should be such as to cause an increase in the quantity of urine. By the judicious use of mild alkaline diuretics, such as the citrate of soda or potash, largely diluted, or infusion of uva ursi, decoction of triticum repens, etc., is accomplished the indication of rendering the urine bland, and of thus causing a rapid subsidence of the cystitis.

The cases of cystitis arising indirectly from disturbance in the cutaneous circulation ordinarily get well when this circulation is re-established, and do not require other medication than such as may render the urine bland. When, however, the cystitis persists, and vesical contracture ensues in any of the varieties of the first group, a more active treatment is necessary, as will be presently stated.

Cystitis from persistent hyperlithuria is of much more frequent occurrence than any of the varieties of this first group, and its management demands close attention. This variety of cystitis is often miscalled irritability of the bladder, and this symptom is treated with opium, belladonna, etc., and the phlegmasia is allowed to progress until permanent contracture of the bladder is established. This cystitis is as amenable to treatment and to cure in its incipiency as it is refractory to either in its advanced stages, particularly after contracture of the bladder is confirmed.

If, when the bladder is said to be irritable, the urine is examined microscopically and found to contain an excess of uric acid, and treatment for hyperlithuria is at once instituted, normal urination is soon restored and all symptoms of beginning cystitis disappear. Patients affected with cystitis due to hyperlithuria are necessarily hyperlithæmic, and this is consequent upon dyspepsia and hepatic engorgement. In such cases there is habitual costiveness, and with this headaches, muscular pains, and other symptoms of ptomainal or leucomainal toxæmia. The treatment should therefore be directed to the restoration of the digestive function and to the remedy of the consequences of its impairment. For these ends the first desideratum is free catharsis; then daily aperient medicines and the so-called hepatics, such as small doses of podophyllin, leptandrin, irisin, colocynth, and nux vomica, combined. At the same time should be prescribed alkaline waters, such as those of Vichy, from the Célestins spring, six ounces four times daily, between meals, for two weeks or, at most, three weeks. When there is a very abundant precipitate of uric acid, causing greater distress than usual, nothing seems to act so quickly as ten grains of salicylate of sodium, largely diluted, four times daily for two or three days only; as such doses are not long tolerated by the stomachs of most patients, their continuance beyond that time is not wise. This should precede the administration of the Vichy water. Five-grain or even ten-grain doses of phenacetin sometimes promptly relieve the muscular pains which so often accompany hyperlithæmia.

During this treatment and for three or four weeks thereafter the patient should abstain from eating starches and sugars, or use them very sparingly, especially at the evening meal. Abstention from all articles of food tending to cause flatulency, and from malt liquors, cider, sweet wines, etc., is essential, as they are known to be so often hurtful to the process of digestion in the cases under consideration. Sufficient bodily exercise, promotion of the cutaneous functions by frequent ablutions and frictions, and clothing suited to the state of the weather, constitute the remainder of the hygienic management.

A medication and hygienic precautions such as have just been described are likely to nip in the bud a cystitis which would otherwise become very distressing and lead to transitory, and finally to permanent contracture with stenosis of the bladder. But contracture of the bladder, even of many months' standing, is not necessarily hopeless and is often cured; but this requires the greatest patience on the part of the physician and of the sufferer.

THE LOCAL TREATMENT consists in the use of medicinal and mechanical means. When acute cystitis is accompanied with transitory contracture, which is a state of rigidity of the muscular coat of the bladder preceded by frequent and painful spasmodic contractions especially at the close of each act of urination, a brisk saline cathartic should first be administered, then half a dozen leeches should be applied to the perinæum and as many to the hypogastrium. As soon as the gorged leeches drop, hot fomentations should be applied to the hypogastrium and continued for two or three days. This local depletion is of much advantage in young robust subjects, but should be omitted in those whose health has already been impaired or those who are known to be intolerant of bloodletting in any form. Two or three liberal doses of opium may be necessary to relieve the pain incident to the acute phlegmasia, and diluent drinks should be given throughout the treatment. A hot hip bath, of five minutes, every night is often very advantageous. No instrument should be introduced into the bladder except in the case of retention of urine, which, however, is of extremely rare occurrence in these cases. After a few doses of belladonna extract, a quarter of a grain four times daily for two or three days, the sensitiveness of the bladder is lessened and it allows itself to be distended by the urine rendered bland by the diluent beverages. Resolution of the phlegmasia begins and the tonic spasms of the bladder cease, so that in the course of a few more days the patient is able to retain his urine several hours, and is soon well.

In chronic cystitis with contracture, if there are not very much thickening and induration of the bladder walls consequent upon interstitial cystitis, mechanical as well as constitutional treatment is required, the indications being to remedy the phlegmasia and to restore to the bladder its normal suppleness and capacity. The constitutional treatment must be used as an indispensable adjuvant to the mechanical treatment, which would otherwise be fruitless.

The inordinate irritability of the bladder and the accompanying distressing and unduly frequent urination incident to cystitis with contracture, react upon the nervous system to the extent of seriously disturbing sleep and of rendering the patient excessively fretful. He is constantly on the alert for the moment to arrive when it is time to urinate, and ever ready to clutch any object that may serve as a fulcrum for his straining efforts. His face then becomes livid and intense suffering is thereon depicted. At the close of the act of urination he throws himself upon his bed exhausted, but not always to sleep, and even then often dreams of his distress. This scene is renewed every hour, half-hour, or even every quarter of an hour. His skin is harsh and inactive, his digestion is soon impaired, his appetite vanishes, his intestinal dejecta are hard and scanty, and he is in no slight degree under the influence of leucomainal intoxication. Such is a true picture of the worst cases. It is therefore wise to endeavor to remedy these several morbid states before they attain this high state of development.

The first prescription should be for a cathartic. The next, for a nightly dose of twenty or thirty grains of sodium bromide, with the object of procuring sleep and of prolonging the intervals of urination. Then thrice daily five minims of tincture of the chloride of iron with a grain of quinine. Other medicinal agents that may be indicated should be used with due regard to the state of the digestive function, and not given beyond the point of tolerance. For instance, diluents should not be continued more than four days, to be replaced by balsamics, which in some cases act so favorably as modifiers of the urine; the balsamics in their turn to be discontinued in favor of some diluent. Belladonna and opium, and, for a change, hyoscyamia, not more than one two-hundredth of a grain thrice daily, are not generally well tolerated longer than four days. Such are the agents required for the constitutional treatment, but they should be used with discretion and judgment, otherwise the desired effect is not likely to be obtained.

GRADUAL HYDRAULIC DILATATION OF THE CONTRACTURED BLADDER.—The mechanical treatment consists in slow, gradual, and progressive hydraulic dilatation of the bladder, and is effected in the manner presently to be described.

An eight-ounce, pear-shaped India-rubber bag with nozzle and stop-cock is filled with a warm solution of mercuric chloride (1 to 10,000), with the addition of thirty grains of boric acid, ten minims of spirit of gaultheria, and half an ounce of glycerin. A curved gum catheter, No. 9 English scale, is introduced into the bladder and all the contained urine is allowed to flow and is measured. Suppose the quantity of urine thus drawn to be one ounce; the nozzle of the India-rubber bag is thrust into the distal end of the catheter, and, by very gently compressing the bag, as much of the fluid is slowly thrown in as the bladder can tolerate without too much pain. The fluid is then allowed to escape through the catheter and is measured. In this manner the capacity of the bladder is determined. It may be of an ounce and a half or two ounces. A second injection at the same sitting determines the degree of distensibility of the bladder, for if, after a very slight increase—two or three drachms over the amount of the first injection—the fluid drawn is tinged with blood, the operator knows that the bladder has been distended beyond its abnormally restricted dimensions, that a slight violence has been inflicted upon its mucous coat, and that he should desist from further attempts at distending the bladder during the sitting, and throw in only one ounce of fluid at a time, simply to soothe and cleanse the bladder, until the eight ounces are exhausted. On the next day, the patient being under the influence of belladonna or of hyoscyamia, the process of injection and dilatation is repeated. It may be that no gain is made over the maximum distention of the previous day, or even that there is a loss, the bladder being less tolerant than before, so that not over one ounce of fluid can be injected. This often happens during the early part of the treatment, but should not discourage the operator, for on the third day's sitting there may be a gain sufficient to more than make up for the loss. With the exception of such retrogressions and the occasional occurrence of slight hæmorrhages, the dilatation is progressive from day to day, though the increase on some days can be measured only by the drop, while on other days it is by the drachm, but later by the ounce, and in the course of five or six weeks the bladder sometimes tolerates eight, ten, or twelve ounces of fluid. When this stage is reached the injections are repeated every second day, twice a week, and finally only once a week, until the cystitis is cured.

A very important point to which the attention of the physician should be directed is the habit that some patients, affected with cystitis and contracture, form of urinating, so to speak, by the clock. Unless this habit be soon broken, the case may well be regarded as hopeless. The example to be given is a fair illustration of this point. A patient, for the relief of whose suffering cystotomy had been proposed, said that he had also been advised to urinate often so as to keep his bladder empty as long as possible. He therefore, for several months, employed most of his time in watching a clock, and whether or not he had any desire to urinate he did so regularly every fifteen minutes. It was very difficult to convince him that he was committing a grave error, but as he was daily getting worse he finally consented to pay no further attention to the minutes by the clock or watch, and in a few days retained his urine half an hour, three quarters, and one hour, and in the course of three weeks the mechanical dilatation of the bladder was carried from two ounces to ten ounces. He was then able to retain his urine four hours. This urine, from being purulent, bloody, and offensive, became clear and normal.

For vesical irrigation and dilatation in chronic cystitis with contracture, sundry other solutions beside that already mentioned may be employed, such as of phenol, permanganate of potassium, permanganate of zinc, acetate of lead, acidulated water, etc.

It may be interesting to note some of the many different substances that have been employed for vesical injections during the past hundred years. Chopart seems to have been among the first to resort to vesical irrigations for the cure of cystitis, although the early lithotomists, among them Franco, used warm vesical irrigations as part of the after-treatment of lithotomy to cure any lingering cystitis, and although in the beginning of the eighteenth century Pierre Desault, of Bordeaux, had used, in calculous cystitis, injections of the mineral water of Barèges. Chopart at first made use of simple warm water, then of barley water, and afterward of acetate of lead dissolved in water. Later, in England and France, others used flax-seed water, soot water, tar water, calomel suspended in an emulsion of acacia gum, wine, normal urine, etc. Still later, copaiba balsam in emulsion, carbonic-acid gas, solutions of hyposulphite of sodium, bromide of potassium, iodide of potassium, tincture of iodine, corrosive chloride of mercury, chloride of sodium, carbonate of sodium, nitrate of silver, sulphate of zinc, alum, tannin, strychnine, morphine, quinine, salicylic acid, resorcin, methylaniline, peroxide of hydrogen, divers mineral waters, etc., with varying but mostly bad results, partly because no attempt had been made to gradually dilate the contractured bladder.

It is often advantageous to change, from time to time, the formulæ of the fluids to be injected, but the essential is to bear in mind the indications of curing the phlegmasia and of restoring to the bladder its normal suppleness and capacity.

This method of gradual hydraulic dilatation of the bladder, employed by Civiale and others of his time, appears to have been soon set aside by many who have been allured by the quicker and seemingly more promising method of sudden dilatation aided by artificially induced general anæsthesia. The quick method, which does serious violence to the bladder, is generally unsafe, often dangerous, and seldom if ever successful. The slight benefit it very exceptionally confers is of short duration, and the old symptoms soon return in a more aggravated form than before. The advocacy of sudden distention of the bladder with a solution of nitrate of silver, thirty grains to the ounce, is even more unwarrantable. This rash procedure has been adopted by many who have regretted it, for when the patients have survived the violence and cauterization, their bladders have become permanently and incurably contractured, stenosed, and thickened from the consequent interstitial phlegmasia.

NITRATE OF SILVER IN CYSTITIS.—In obstinate cystitis nitrate of silver is unquestionably a valuable therapeutic agent when used at the right time and in solutions of suitable strength, but very strong solutions not only fail to cure but do serious mischief. After the bladder has been gradually dilated to eight or ten ounces and the same amount of urine is retained without causing pain or hæmorrhage, if this urine is still purulent, a weak solution of nitrate of silver may, with much advantage, be employed for irrigation every four or five days. A grain of crystallized nitrate of silver is dissolved in eight ounces of distilled water, then, after having drawn off all the urine contained in the bladder and washed it twice with pure water, two injections of four ounces each are rapidly made with the nitrate-of-silver solution. In four or five days the process is repeated, but the quantity of nitrate of silver is doubled. After this the solution is gradually increased in strength to three, four, eight, and sixteen grains of nitrate of silver to the eight ounces of warm water, and it is very rarely necessary to increase the strength of the solution to thirty-two grains to the eight ounces, for, after eight or ten sittings, all the good that may be expected is accomplished. Guyon, of Paris, uses the nitrate-of-silver solution by way of instillations of ten, fifteen, twenty, or thirty drops of the strength of from five to sixty grains to the ounce, once and sometimes twice daily, principally in trachelocystitis.

As far back as the latter part of the last century strong solutions of nitrate of silver were used in the treatment of cystitis, from fifteen to sixty grains to the ounce of distilled water. In some instances, instead of the silver salt, corrosive chloride of mercury was used in the same strength and, it is said, with the same effect. Long afterward Trousseau began to use, for vesical injection, the mercuric chloride, but only at the rate of about a quarter of a grain to the ounce. Bretonneau was a strong partisan of vesical injections, and finally employed nitrate of silver in cystitis, but his solutions did not exceed a quarter of a grain to the ounce. In 1842 Mercier revived the use of strong solutions of nitrate of silver, beginning with fifteen grains and gradually increasing to sixty grains to the ounce, and this treatment was adopted by Ricord and others, and is to this day employed.

The advocates of strong solutions declare the weak solutions to be worthless because, they say, the urine decomposes the nitrate of silver, converting it into an inert chloride, and they further say that thirty minims of urine suffice to decompose a grain of nitrate of silver. When the precaution is taken of carefully washing the bladder immediately before making the injection, surely enough urine does not enter by the ureters to decompose a grain or a quarter of a grain of nitrate of silver rapidly thrown in, and it should be remembered that two injections are made in quick succession within a minute or before the sixteen minims of urine which it receives per minute can possibly act upon the silver salt. Even in the event of polyuria, if the urine entering the bladder should be increased to thirty minims or to sixty minims a minute, which would be half a minim in the one case and one minim a second in the other case, it would not be sufficient to decompose the weakest of the proposed solutions, for to inject four ounces of fluid in the bladder requires not more than ten or twelve seconds of time, the increase in the saline not being necessarily proportionate with the watery element. Besides, as a proof that the weak solutions of nitrate of silver do act upon the mucous membrane of the bladder before the salt can be decomposed by the chlorides as well as by the acid phosphates, the injections are almost invariably followed by a burning pain, which lasts from twenty to thirty minutes, and by frequent and urgent desire to urinate for two or three hours. Without there being enough urine in the bladder to decompose the nitrate of silver, the ejected solution has a milky appearance, indicating its conversion into a chloride. The action of nitrate of silver is primarily upon the epithelium. A solution of moderate strength coagulates the albumin of the superficial epithelial layer, and in so doing is decomposed into an insoluble chloride. But a very strong solution is likely to act upon all the epithelial layers, and even to penetrate more deeply and coagulate the albumin and gelatin of the fibrous layer of the mucous membrane before it is decomposed, and the irritation it causes leads to interstitial cystitis. Here, then, lies the main objection to the use of strong solutions.

The repeated application of strong solutions of nitrate of silver to mucous membranes has been demonstrated to cause induration not only of the mucous membranes themselves but of their underlying connective tissue. These membranes soon lose their elasticity, being, as it were, tanned, and often spoken of as leathery. This condition of sclerosis has been observed on a large scale in the fauces among patients that had been treated during the great craze of thirty-five years ago for cauterizing the human fauces on the most trivial complaint of "sore throat," and was commonly termed the nitrate-of-silver throat, from which they never recovered. A similar condition has been observed during life in the urethra, from frequent applications of strong solutions of nitrate of silver and other irritants. The bladder may recover from the effects of a single injection of a strong solution of nitrate of silver, but when the strong injections are several times repeated in accordance with the directions given by those who advocate their employment, the delicate mucous membrane of this organ must suffer much more than other mucous membranes that are not the recipients of such an irritating excrement as the urine, and whose outlets are free and broad.

CYSTOTOMY, INFRAPUBIC AND SUPRAPUBIC, has been frequently performed during the past forty years for the cure of obstinate cystitis with contracture of the muscular coat of the bladder uncomplicated by the presence of a tumor, stone, or foreign body, or by prostatic obstruction. The alleged effect of this operation is that it affords complete drainage of, and rest to, the bladder, and therefore cures the cystitis and contracture.

The analysis of a considerable number of reported cystotomies for chronic cystitis uncomplicated with vesical tumors, stones, or foreign bodies, shows that the relief afforded by the drainage was only temporary, and that they had failed to cure the cystitis and contracture.

It is not desirable nor is it possible to keep open the neck of the bladder more than three or four weeks. Cicatrization takes place within that period, notwithstanding the use of dilating instruments, and the natural action of the vesical neck is restored and prevents the urine from escaping involuntarily. The insertion through the external wound and the long retention of a large tube does not prevent cicatrization of the urethro-vesical wound, and this tube acts injuriously as a foreign body. There is no curative power in rest and drainage of the bladder in the case of cystitis and contracture. The temporary drainage, in the most obstinate and distressing cases, may sometimes be of advantage as preparatory and adjuvant to the hydraulic dilatation of the bladder without which no permanent cure need be expected, and this dilatation should be employed a few days after the perineal cystotomy. The fluid for irrigation is heated from 105° to 110° F., and thrown in very slowly, one, two, or three ounces at a time, until a pint is used. This process is repeated once each day until eight, ten, or twelve ounces can be injected at once, but before this is accomplished the wound will have healed.

In the case of suprapubic cystotomy a fistula has been kept patent for months, and in some instances for years, but without curing the cystitis or the contracture.

The prescription of long rest to the bladder in these cases does not seem rational, since it is well known that the prolonged immobilization of any part so surely leads to its permanent contracture. The muscular walls of the bladder need to be exercised in cases of cystitis with contracture which has not become permanent, and this exercise is attainable by hydraulic expansion, which gradually restores to the bladder its normal suppleness and capacity.

THE TREATMENT OF ACUTE TRACHELOCYSTITIS, due to the extension of acute urethritis, consists in recumbency, a light regimen, the administration of diluent drinks to render the urine bland, the use of belladonna and opium by mouth or rectum, of hot fomentations to the hypogastric region, and of daily warm baths. For ordinary cases this treatment suffices to induce resolution in the course of a week or ten days. Balsamics are often prescribed, but only serve to disturb digestion. Other cases attended with great pain and dysuresis require local depletion, such as may be effected by leeching the perinæum, and the substitution of cold for warm applications, the cold being applied within the rectum by way of ice suppositories. No instruments should be introduced into the urethra except in the event of retention of urine. In these severer cases it is necessary to give free doses of alkalies, such as the bicarbonate of sodium, thirty or forty grains, largely diluted, four times daily for three or four days, and to increase the doses of belladonna and opium. Though the pain and urgent and frequent urination diminish under this treatment, resolution is frequently incomplete, and the affection becomes chronic. It is in these chronic cases that Guyon's method of instillations of nitrate-of-silver solution is of the greatest service; but this will be detailed in the discussion of chronic prostatitis.

The treatment of cystitis due to injuries of the bladder will be stated in connection with the subject of traumatic affections of the urinary organs.

TREATMENT OF CALCULOUS CYSTITIS.—When cystitis is caused by the presence of a calculus or of a foreign body, it is sometimes necessary to prepare the bladder for the removal of either irritant. The bladder may be spasmodically contracted around the calculus or the foreign body to such a degree as to gravely interfere with the play of the instruments introduced for the destruction or the removal of the intruder. In such a case the preparation begins with the ad ministration of a few free doses of belladonna and opium for two or three days. During this time the bladder is daily irrigated with a warm, soothing antiseptic solution, dilating it gradually as much as necessary for the safe destruction of the calculus or the extraction of the foreign body; either operation being successfully performed, the after-treatment consists in daily irrigations tending to cure the phlegmasia and to restore the bladder to its normal state.

IN THE MANAGEMENT OF CYSTITIS DUE TO OBSTRUCTION BY LOCAL URETHRAL STENOSIS the physician is guided by the character and caliber of the stricture, by its complications, and by the general physical state of the patient. If the stricture, though very narrow, is free from complications and susceptible of expansion, its gradual dilatation is at once begun and practiced every third or fourth day. As soon as the urethral canal is thus sufficiently enlarged at the strictured point to render urination moderately free, the acts are less painful, less frequent, the bladder is soon emptied, and the cystitis begins to subside, to be well, as a general rule, when the urethra is dilated to its normal caliber. When, however, the stricture is not dilatable beyond three or four millimetres, it should be cut longitudinally from within, and a catheter introduced to draw off the purulent urine and to permit the thorough cleansing and disinfection of the bladder. The catheter is afterward used for every act of urination, and the bladder washed once each day until there are no more signs of cystitis. If there happens to be vesical contracture, gradual hydraulic dilatation becomes necessary. When internal urethrotomy is contra-indicated by reason of the extreme narrowness of a stricture seated in the scrotal or perineal region, especially if there be a urinary fistula or an abscess, the operation of external perineal urethrotomy should be performed without delay, to give free vent to the urine; but this urine should be drawn off by means of a large catheter passed through the wound, and the bladder thoroughly cleansed once or twice daily. If there is no serious complication toward the upper urinary organs, the cystitis is likely to be cured, or nearly so, before the external wound is fairly healed.

The cystitis of elderly men affected with prostatic enlargement requires unremitting attention from the earliest period of its development, because of the grave consequences that arise from neglect to relieve the bladder of the stagnant urine which so surely undergoes fermentation with the conversion of its urea into carbonate of ammonium, and the extension of the consequent phlegmasia to the whole of the vesical mucous membrane and even to its underlying fibrous coat. This cystitis is generally of slow development. At first the urine contains very little pus, only the lower fundus of the bladder being affected. The amount of residual urine may not exceed an ounce, but this residuum gradually increases until the bladder is abnormally distended. The urine is then ammoniacal, slimy, and fœtid, and urination is unduly frequent and very painful. If before the cystitis reaches this state of development the catheter is used once or twice daily and the bladder is properly cleansed, further fermentation is prevented and the phlegmasia subsides. But if the cystitis has already extended to the whole vesical mucous membrane, proper measures should be taken to check the ammoniacal conversion of the urea of the urine and to counteract its ill effects. The amount of urea metamorphosed into ammonium carbonate is not less than two per cent., or nearly ten grains to the ounce of urine. This percentage of ammonium carbonate is quite sufficient to excite cystitis, to act upon the albumin of the pus-corpuscles, and to saponify the fats of the pus, the result of these changes being the slime, miscalled ropy mucus, which is sometimes so tenacious that it can not be extracted through an ordinary catheter. There are two ways of relieving a bladder gorged with tenacious slime. One is to convert the carbonate into an acetate of ammonium by throwing in largely diluted acetic acid, thus liberating the fats and liquefying the slime, which then assumes a milky appearance; the other is to remove the slime by aspiration through a large-sized catheter.

The bladder is then to be emptied by means of an ordinary catheter five or six times every twenty-four hours and thoroughly cleansed with an antiseptic solution once and sometimes twice daily, night and morning. About ten ounces of fluid at a temperature of 105° to 110° F. may be employed for this purpose, one third to be injected and three successive injections to be made at each sitting. The substances dissolved may be varied from time to time—boric acid with the corrosive chloride of mercury, phenol, permanganate of potassium, etc.—and continued as long as the urine is alkaline. When the urine resumes its normal acidity the injections need not be used oftener than twice a week, but the use of the catheter should not be abandoned. When the urine contains phosphates in great abundance, two grains of acetate of lead to the ounce of warm water, with two minims of acetic acid, may be used with good effect, there being a double decomposition and the formation of a soluble acetate of the bases, and of an insoluble phosphate of lead. Water acidulated with nitric or hydrochloric acid, two or three minims to the ounce, may also be used with advantage. These two means constitute the prophylaxis of phosphatic stone.

One of the gravest of the consequences of the cystitis of elderly men suffering from prostatic obstruction is contracture with diminished capacity of the bladder; this, happily, is of comparatively rare occurrence, while contracture with increased vesical capacity is the rule. These patients are tormented by constantly painful and unduly frequent urination, and, if allowed, would introduce the catheter every half-hour, for they suffer all the pangs of acute retention of urine, and their bladders bear very little if any artificial hydraulic distention. Though they are the most hopeless of all cases, their suffering is often alleviated by free doses of belladonna and opium, and by one or two daily injections of warm water rendered denser by the addition of glycerin and some salt of sodium or potassium.

The physician is sometimes called upon to minister to the suffering caused by complete retention of urine, another grave complication of the cystitis arising from stagnation of urine due to prostatic obstruction. His duty in such a case is to ascertain the degree of enlargement of the prostate and the exciting cause of the occlusion of the urethrovesical orifice. He may learn, by patient cross-examination, that the sufferer had been exposed to inclement weather, or had committed some excess, or that his rectum had not been relieved for several days, etc. He may also learn how long since the bladder had been emptied, whether the patient or any one else had used a catheter, and if so what kind of catheter; if catheterism had been unsuccessful, how many times it had been tried; whether hæmorrhage had followed the attempts made to enter the bladder, and whether he had had any chills after the catheterisms. Then he should make a general examination of the case to ascertain the condition of the patient and the degree of distention of the bladder. If he finds the patient suffering much constitutionally from his ailment he should not at once resort to catheterism, but first administer a broth, a stimulant, and an opiate, and finally an enema to empty the rectum. In an hour or two he may select a suitable catheter, introduce it and draw off only a pint of urine, two hours after this another pint, and so on every two or three hours until the bladder is empty. The dangerous procedure of precipitately evacuating the overdistended bladder of elderly men has already been pointed out, but an example will be given later. The best instrument for ordinary use is a No. 9 English curved gum catheter. If on account of a longitudinal rent in the prostate the point of the catheter is arrested and by gentle manipulation can not be made to enter the bladder, the instrument should be withdrawn and armed with a properly curved metal stylet and reintroduced after the manner of William Hey, which consists in carrying the instrument to the point of obstruction and in then withdrawing the stylet, at the same time pushing in the catheter seized with the left thumb and index. The suddenly increased curve changes the direction of the vesical extremity of the instrument, and the bladder is thus entered. If no urine flows it is probably because the eye of the catheter is obstructed by a clot of blood which can be driven out by injecting quickly through the instrument an ounce or two of water. It sometimes happens that this method of catheterism fails. Then the invaginated catheter of Mercier may be substituted with the fairest prospect of success. This ingenious contrivance has many times obviated the necessity for puncture of the bladder, which is to be regarded as an evil and performed for temporary relief only, in case suitable catheters can not be procured for many hours. The invaginated catheter consists of two catheters—one metallic, the other non-metallic. The first or female part is a thin-walled No. 10 English silver catheter, eleven inches long, very slightly curved, and having in its concavity, about half an inch from the point, an oval eye five eighths of an inch in length and three sixteenths in breadth. From the vesical extremity of the eye is an inclined plane, which is lost in the floor of the opening at a distance of a quarter of an inch, serving to tilt up the point of the male part. This male part is a flexible but firm "gum" catheter, No. 7 English, eighteen inches long, fitting loosely in the lumen of the female part, and having a single eye an eighth of an inch from its point. The manner of using the invaginated catheter is to introduce the male into the female part as far as the eye of the female part, then to pass the instrument as far as the obstacle and engage the point of the metallic part in the false route, and finally to project the male part, which will override the false route thus blocked and enter the bladder. The female part can then be withdrawn and the male part left in as long as may be required; this is the reason for the increased length of the male part.

In case of multiple false routes in the prostatic region and of failure of all methods of catheterism, the patient is rendered insensible by ether, or, better, by nitrous-oxide gas, and is placed in the lithotomy position. A grooved steel staff is then introduced into the urethra as far as possible, a median incision is made in the perinæum, the membranous urethra is laid open longitudinally with a bistoury, the left index finger is passed as far as the bladder to serve as a guide for a broadly grooved director; the finger is then withdrawn, and, with the guidance of the director, a deep downward cut is made with a long-bladed beaked bistoury in the median line through the base of the prostate, including the neck of the bladder. Before withdrawing the director a soft India-rubber tube of not less than ten millimetres in diameter is introduced and retained in position for forty-eight hours. Meanwhile the bladder is irrigated twice or thrice daily. After the withdrawal of the tube, the same, or one slightly smaller, is used once or twice daily to cleanse the bladder, though the urine may be flowing involuntarily. In the course of three or four weeks the false routes and the external wound heal by granulation, and ordinary catheterism may be employed to empty the bladder.

VESICAL HÆMORRHAGE.—When the overdistended bladder has been precipitately emptied and an abundant hæmorrhage has ensued, this viscus should not again be allowed to become distended, and means should be promptly taken to arrest the hæmorrhage. In such a case may be administered twenty-minim doses of fluid extract of ergot every two or three hours, or ten grains of gallic acid dissolved in glycerin, or the same quantity of quinine dissolved in dilute sulphuric acid. Vesical injections of cold water, slightly acidulated with acetic acid, may be made after each evacuating catheterism. Then it is essential that the bladder be kept empty. So long as the urine is much in excess of the effused blood, this blood retains its fluidity; but when the blood is in excess, coagulation rapidly takes place and the bladder is soon distended with dense clots which can not be extracted until they are broken up and removed by aspiration through a large catheter.

A vigorous farmer, seventy years of age, was seen in consultation at his home on the last day of June, 1891, on account of profuse vesical hæmorrhage due to his having suddenly emptied his overdistended bladder five days before when he had ridden forty miles in a light carriage. The bladder was filled with clots and distended to the level of the umbilicus. Notwithstanding the existence of prostatic obstruction, catheterism was easy, but, after a little bloody urine had escaped, a clot occluded the gum catheter. A metallic catheter, ten millimetres in diameter, was substituted and moved in different directions to break up the clots, several ounces of which were aspirated by means of Bigelow's instrument. A lithotribe was then used to further break up the clots, and these were likewise aspirated. After this several injections of diluted vinegar were made and the patient allowed to rest and sleep for three hours, when catheterism was again employed, but with a smaller instrument, which was not this time obstructed, and a pint of bloody urine drawn. After several cold irrigations with ten per cent. of vinegar the ejected fluid contained very little blood and no more clots. The hæmorrhage gradually lessened and ceased on the third day. It had lasted eight days in all. Meanwhile evacuative catheterism had been practiced every five hours. In a week the family physician wrote that the patient was in good condition, though he had been troubled with polyuria, which necessitated the more frequent use of the catheter, and that the cystitis was under control, the bladder being daily irrigated. The patient is at this date in excellent condition.

TREATMENT OF THE CYSTITIS DUE TO DISEASE OR INJURY OF THE GREAT NERVE CENTERS.—The discussion of the treatment of cystitis will now be closed with some hints respecting the management of the cystitis which arises from stagnation and fermentation of urine due to disease or injury of the great nerve centers. In patients who survive grave lesions of the brain or of the spinal cord for weeks or months it has long since been observed that frequently the immediate cause of death is traceable to consecutive lesions of the urinary organs, such as cystitis, ureteritis, pyelonephritis, calculous formation, etc., all arising from stagnation of urine in the bladder, whose sensibility is blunted or even destroyed, owing to the nerve-center lesion, and that when early attention is given to the impaired urinary organs while the primary disease or injury is undergoing treatment, the life of the patient is prolonged and his suffering lessened. The needed treatment is simple and effective, so far as the urinary organs are concerned. Very soon after a patient becomes paraplegic his bladder ceases to act and rapidly fills with urine; therefore it should be artificially emptied at once, if it is not overdistended. So long as the urine is clear and of acid reaction, simple evacuative catheterism, practiced at regular intervals, suffices to prevent stagnation and cystitis. But when the urine is already turbid and alkaline the bladder should be irrigated once or twice daily with suitable solutions. This plan of treatment has been current in Bellevue Hospital for the past twenty-six years, and it is believed that the lives of many patients have thus been prolonged for months and even for years. Experienced surgeons know so well how commonly, in depressed fractures of the skull, the bladder becomes distended with urine, that the first direction they give to their aids is to empty the patient's bladder, with the object of preventing overdistention and cystitis.

VII.

PROSTATITIS AND BULBO-URETHRAL ADENITIS.

Prostatitis—phlegmasia of the vesical prostatic body—may begin and end in the glandular part (parenchymatous prostatitis); it may thence extend to the interstitial connective and muscular framework of the prostate body (diffuse prostatitis), or it may occur in the peripheral connective tissue (periprostatitis). The phlegmasia may be superacute, acute, subacute, or chronic.

Causes.—Prostatitis may arise from urethritis, from venereal excesses, from the contact of some irritant with the mucous membrane of the prostatic region of the urethra, such as often repeated strongly astringent injections in the treatment of "gonorrhœa," from external injury, from violent catheterism, or from exposure to cold and dampness. The superacute and acute types are of very rare occurrence, and generally caused by the extension of acute or superacute urethritis into the prostatic ducts and follicles, whence the phlegmasia diffuses itself into the interstitial substance, and sometimes extends into the peripheral connective tissue. This is sometimes excited by the so-called abortive treatment of "gonorrhœa" by the injection of a strong solution of nitrate of silver. The subacute type affects at first the parenchyma only, but later invades the interstitial substance, and may gradually pass into the chronic type.

These several types of phlegmasia are apt to leave the no harm ensues, but when there happens to be a large opening, the dangers of destruction of the whole prostate by the urine, and of consequent pyosapræmia, are great.

A case illustrating this point occurred in 1864 at Bellevue Hospital. The patient, a young man, was suffering from retention of urine consequent upon a prostatic abscess. For his relief a silver catheter was introduced, but met, in the prostatic region, with an obstruction, which was, however, overcome, the incidental pressure causing the instrument to suddenly advance about an inch, when two ounces of creamy pus flowed, but the bladder was not entered. From that time the bladder relieved itself spontaneously. Symptoms of pyosapræmia supervened, and the patient died in two weeks. The necropsy revealed a ragged opening in the floor of the urethra leading to a large cavity, with sloughy walls, containing stale urine and pus. The whole prostate was disorganized.

When the abscess points toward the rectum, digital exploration reveals fluctuation in that situation; the prostate, hard and tender during the periods of increase and stasis of the phlegmasic process, is now soft and little sensitive to the touch, one lobe or both lobes being in this state of suppuration.

In periprostatitis, which is caused most frequently by violent catheterism, the abscess often points forward toward the perinæum. The abscess very rarely points backward. The great danger in such cases lies in its breaking into the peritoneal cavity. When the bladder is empty the recto-vesical fold of the peritonæum descends to about half an inch of the base of the prostate, but as the bladder fills, the peritonæum ascends with it so that the antero-posterior space uncovered by peritonæum is doubled in extent. In some instances, however, as shown by the specimens exhibited, the peritonæum reaches and even overlaps the base of the prostate. These facts are sufficient to account for the occasional occurrence of peritonitis in cases of acute prostatitis.

In the treatment of the acute types of prostatitis, local antiphlogistic measures should be promptly adopted, the main indications being to prevent suppuration and hasten resolution. Antiphlogistic treatment is, however, applicable only during the stages of increase and stasis. Later, that is to say, when there are already signs of softening and suppuration, this treatment is of no avail, and may even be harmful.

In any case of acute prostatitis the first inquiry of the physician should relate to the condition of the bladder. If he finds retention of urine, he should lose no time in relieving the distended bladder. Unless the bladder is kept empty, any mode of treatment tending to favor resolution of the phlegmasic process in the prostate must inevitably fail, for the distended bladder mechanically impedes the venous circulation in its vicinity. Catheterism in cases of swollen prostates is often very difficult and requires the utmost caution and gentleness. The use of metallic catheters is unjustifiable in the vast majority of cases of retention of urine from acute prostatitis. The safest and most efficient instruments for this purpose are the soft, curved, so-called gum catheters, not larger than No. 9 of the English scale. Such catheterism is ordinarily required every five or six hours for at least a week. Recumbency is, of course, enjoined.

After the intestinal tract has been emptied, the rectum should be thoroughly washed. Immediately after the cleansing process three or four leeches should be applied to that part of the rectum underlying the prostate. This can be conveniently accomplished with the aid of the leech-tube devised by Dr. James S. Hughes, of Dublin. This tube is much better than those of Bégin, Henderson, and Craig. The following is Dr. Hughes's description of his leech-tube:

"The instrument . . . consists of a curved gum-elastic or gutta-percha tube, of about six inches in length, open at one extremity, closed at the other, the latter being rounded off and inverted or bell-shaped, and perforated with two or more conical holes capable of enabling the leeches to do their duty but not to escape through. The lesser curve of the tube is grooved or concave externally. The following is the mode in which the instrument should be used: The patient having been placed in the kneeling posture, the surgeon should pass the forefinger of his left hand, previously well oiled, into the rectum with a gentle rotatory motion, until it has reached the inflamed prostate; he then should take with his right hand the leech-tube, previously oiled and furnished with from one to four leeches, as the case might be, and pass it along the curved dorsal aspect of the left forefinger to the exact spot where the leeches ought to be applied, the left forefinger acting as a director to the leech-tube, and forming with it, as it were, one instrument, the concave surface of the tube traversing and adapting itself to the convex surface of the finger. By this simple contrivance leeches can be brought and kept in contact with the rectal surface of the prostate without danger of their escaping from the instrument into the intestine, on the one hand, or of the tube becoming blocked with feculent matter on the other." These leech-tubes of Dr. Hughes's have lately been made of glass.

There may be circumstances forbidding the application of leeches to the rectal mucous membrane. In such cases, ten or twelve leeches may be applied to the perineal and anal regions, the effect of either mode of leeching being to disgorge the præ-prostatic plexus of veins and thus relieve the blood stasis in the capillary vessels of the prostate.

When it is judged that a sufficient amount of blood has escaped after the dropping of the leeches, the rectum should be cleansed and then packed with ice, which should be renewed as fast as it melts, means, such as the introduction of a gum-elastic tube, being provided for the escape of the water if it does not flow freely during the insertion of new ice suppositories. This ice treatment should be continued two, three, or four days, according to the necessities of the case. The relief afforded by the cold is great, and enables the patient to obtain much refreshing sleep. During the day the ice is renewed every half-hour if need be, but once every two hours in the night generally suffices, the patient waking to ask for a renewal of the ice suppositories. Should it not be possible to continue the use of ice by the rectum, an India-rubber bag filled with ice could be applied to the perinæum, and the benefit of dry cold thus obtained.

During these three or four days catharsis should be kept up by drachm doses of sulphate of sodium, dissolved in three ounces of hot water, every four hours. Tartarized antimony was formerly given in doses of one eighth of a grain every four hours, but this can now be judiciously replaced by diaphoretics that cause less depression than the antimonial salt.

To insure diuresis, from forty to sixty grains of bicarbonate of sodium should be given in six ounces of water three and even four times daily. This alkali, in such cases, acts as an antiphlogistic and as a diluent counteracting the acridity of the urine. A full dose of morphine by the mouth or hypodermically serves the purposes of relieving pain and inducing sleep. The diet should be restricted to broths and bread and milk.

If resolution begins within a week from the onset of the phlegmasia, it may be promoted by hot enemata, hot fomentations to the hypogastric and perineal regions, and a hot hip bath of five minutes' duration every night. Internally, five grains of chloride of ammonium may be given four times daily, and mild saline aperients administered every morning. Under favorable circumstances, in the course of two or three weeks from the beginning of resolution the prostate nearly regains its normal condition. Reconstituents and a generous diet are then indicated.

When resolution fails and suppuration occurs, the sooner the pus is allowed free outlet the better. If the pus is discharged into the urethra, the greatest care should be taken to prevent the urine from entering the abscess cavity. The patient should not be allowed to urinate spontaneously, but the catheter introduced, as before, every five or six hours, for two or three weeks after the first gush of pus, so as to give time for contraction of the cavity and healing by granulation from the bottom. If the pus points toward the rectum, a Sims speculum should be introduced and a sufficiently free incision made into the abscess, whose cavity should be well disinfected and loosely packed with antiseptic gauze. If the cavity is very small, it may be left to granulate without packing. When, as in periprostatitis, the abscess points toward the perinæum, if fluctuation is detected by perineal palpation, a central perineal incision answers the purpose of emptying it; but if the indications of suppuration are entirely by rectal exploration, a crescentic incision, followed by careful dissection between the urethra and rectum, is required to safely reach the purulent focus, after whose evacuation and cleansing with peroxide of hydrogen solution the same dressing may be made as in the other cases. As a general rule, the parts heal by granulation in the course of four or five weeks.

Prostatitis from exposure to cold and dampness is not an uncommon occurrence among elderly men whose urination may or may not have been impeded before such exposure. From the cases observed, three are selected to illustrate the ill effects of a phlegmasia which involves the mucous membrane of the prostatic region and of the urethro-vesical orifice, together with a very superficial layer of the prostatic parenchyma, causing an œdematous swelling of the mucous membrane that may be likened to œdema of the glottis from the suddenness of its invasion and rapidity of swelling. In two or three hours after the exposure there is frequent and difficult urination, and, within six or eight hours, retention of urine.

A patient, sixty-six years of age, who had never had any hindrance to urination, left the city, in apparent good health to spend the night at his suburban residence, on a cool mid-September evening. From the railway station to his house the distance is about a quarter of a mile. He walked briskly and was somewhat heated on his arrival. He remained for a time out of doors, and, desiring to urinate, exposed his pudendal region in the act of relieving his bladder. At that moment he experienced a distinct chilly sensation, and thought nothing of it until later in the night, when he was several times obliged to urinate. Before sunrise the frequency of urination had greatly increased, so that he was disturbed every ten minutes, suffering much burning pain at each act. He returned to the city early in the morning, when he was unable to pass a single drop of urine. The catheter was used, much to his relief, but he could not afterward urinate spontaneously. He died within six months from the date of the attack. The necropsy revealed a hard, thick, bar-like obstruction at the urethro-vesical orifice, but the prostate was very little enlarged. This urethro-vesical bar indicated that supramontanal enlargement had begun, but was not sufficient to interfere with urination until the advent of the acute phlegmasic swelling.

It is evident that the continuance of the obstruction was owing to an abundant unresolved exudate.

A similar accident happened to a patient, fifty-eight years of age, who sat for several hours in the evening on the piazza of a watering-place hotel late in the autumn, the air being chilled and the fog dense. During the night he was unable to urinate, and from that time was compelled to rely upon the catheter for relief. He had never before had any impediment to urination.

A patient, sixty-three years of age, who in the course of the previous ten years had several times suffered from retention of urine, imprudently sat during the evening on the stone steps of his house late in the month of August. At length, feeling chilly, he went to bed. In the morning he was unable to urinate, and from that moment required frequent catheterism for nearly two months, after which he was able to urinate spontaneously, but could not completely empty his bladder, the urethro-vesical obstruction having become permanent. At the time of the retention of urine the prostate was considerably swollen, but was afterward reduced to nearly its normal size, except, of course, in the supramontanal region.

The same phlegmasia occurs very commonly in young and middle-aged subjects from exposure to cold and dampness during the decline of acute urethritis or during a debauch. This has been improperly called acute inflammatory stricture. The bladder, suddenly distending, causes great suffering, and the patient is likely to apply for relief during the first day. Not many years ago these cases were subjected to vigorous antiphlogistic treatment, but of late years the first care has been to empty the bladder by the prompt introduction of a gum catheter. This is followed by the use of ice suppositories for a few hours, and then by free catharsis. Sometimes a single catheterism suffices, but it is ordinarily advisable to enjoin two or three days of recumbency and the free use of diluent beverages. Deliquescence, or at least very rapid resolution, generally occurs in these last-named cases.

THE CHRONIC TYPE OF PROSTATITIS—variously named catarrhal prostatitis, mucous prostatitis, follicular prostatitis, canalicular prostatitis, prostatorrhœa, etc.—is of much more common occurrence than the acute types, and begins in the mucous membrane of the prostatic sinus, reaching finally the utriculus, the prostatic ducts, crypts, and interstitial tissues. Its development is so gradual that often it is not recognized for a long time. It is ordinarily one of the phases of chronic urethritis, whether this urethritis be the outcome of acute urethritis, of masturbation, or of venereal excesses, or whether it is excited by hyperlithuria, by the lodgment of urinary calculi in the prostatic sinus, by chronic cystitis, by a urethral stricture, by frequent catheterism, by the extension of phlegmasia from the seminal vesicles, by the irritation caused by hæmorrhoids, or by the prolonged retention of catheters in the bladder. Chronic prostatitis may also be a sequel of acute prostatitis. Although chronic prostatitis ordinarily affects young and middle-aged men, it not infrequently occurs among elderly men suffering from prostatic enlargement. In these cases it is the outcome of the frequent catheterism rendered necessary by the urethro-vesical obstruction.

The chief symptoms of chronic prostatitis are sensations of fullness and weight in the perinæum and rectum, perineal tenderness experienced in the sitting posture, dull pains in the perineal and anal regions increased by active exercise and sexual contact, pains in the lumbo-sacral region and in the lower extremities, occasional painful seminal emissions, costiveness, frequent urination, painful urination particularly at the close of the act, a slight muco-purulent, yellowish urethral discharge, and, during defecation, a free urethral discharge of milky prostatic fluid rendered slightly viscous by the admixture of the secretion of the urethral mucous glands. The characteristic odor of the mucus of these glands is imparted to the prostatic fluid and semen, which, by themselves, are odorless. To this last symptom the name prostatorrhœa owes its origin, and from this symptom arose the erroneous popular belief that the glairy fluid in question was semen. To some patients this discharge of prostatic fluid is a source of much anxiety. They imagine themselves affected with seminal incontinence and even impotency, and become the easy victims of designing charlatans. In certain cases the sexual act is attended with so much pain that it is at last abandoned and in time the desire is abolished. Such patients become sullen and lead a life of seclusion, their thoughts are centered upon their supposed infirmity, and their forebodings are of countless imaginary evils. This mental state is more likely to exist in men whose health is already impaired, but undoubtedly causes its further deterioration. Their sedentary life leads to loss of appetite, disturbance of digestion and consequent hyperlithuria, costiveness, leucomainal toxæmia, languid circulation, etc.

The physical characters of chronic prostatitis become known partly during life and partly after death. Beginning in the mucous membrane of the prostatic sinus, it gradually invades the ducts, the crypts, and the interstitial tissues. In some cases the prostate is soft, in other cases it is indurated. Either condition may be ascertained during life by digital rectal exploration.

In a large proportion of cases of chronic prostatitis the mucous membrane of the prostatic sinus is in a granular state, which can be seen with the aid of the urethroscope. In some cases small retention cysts from the occlusion of ducts, or degeneration cysts from isolated gradual degenerative processes, or abscesses from sudden local necrosis, are slowly developed in the substance of the prostate and are detected by rectal exploration with the finger, and by subsequent puncture with a small trocar. Very rarely it is found that the greater part of one lobe is destroyed by an abscess.

Dissection of the prostates of patients affected with chronic prostatitis, dying from some intercurrent disease, has revealed the granular condition to which reference has already been made, the granular mucous membrane being red from congestion up to the vesico-urethral orifice, a spongy, soft state of the prostate, which is somewhat larger than natural and may contain degeneration cysts or small abscesses, or a hard state of the prostate, which is decreased in size and sometimes contains retention cysts, and the utriculus occasionally filled with pus.

When the prostatic crypts have become involved in the phlegmasic process, their microscopic sympexia are set free by the exudate and are then metamorphosed into calculi which, by the accretion of concentric phosphatic layers, attain in time very considerable dimensions. In one case a thousand such calculi, each about half a millimetre in mean diameter—except three, one of which weighed three grammes fifty centigrammes, and the other two weighed together twenty centigrammes—were removed, through a perineal incision, from the prostate of a man twenty-six years of age. In another case eighteen prostatic calculi were similarly removed from a man fifty-four years of age. These eighteen calculi averaged seven millimetres, the largest measured ten by fourteen millimetres, the smallest three millimetres; the whole weighed one hundred and forty grains—about nine grammes. Both patients were cured by the operation.

In perhaps five per cent. of the prostates dissected during the past twenty years, several small calcareous concretions have been found occluding the mouths of prostatic ducts or lying free in the prostatic sinus, and in a much greater percentage of these prostates, particularly those of elderly men, the calcareous transformation was verified by the inordinately gritty state of the substance of the organ. This it seems is evidence of chronic phlegmasic action sufficient to disturb or even to kill the sympexia, which then become foreign bodies. It is when these foreign bodies are not speedily cast away that they receive successive layers of calcium phosphate until they greatly dilate and finally destroy most of the prostatic crypts.

In chronic prostatitis arising from narrow urethral strictures, not only are the ducts dilated by the refluent urine, but the prostatic sinus also undergoes expansion. One of the specimens exhibited is from an extreme case of ectasia, the prostatic sinus being dilated to the extent of containing at least thirty grammes (one ounce) of fluid, the substance of the prostate being soft and spongy.

The diagnosis of chronic prostatitis is based upon close analysis of the symptoms, examination of the urine, physical exploration, the anatomical characters, and the history of the affection. The symptoms can be rightly interpreted only in connection with the examination of the urine and the physical exploration.

The urine of patients affected with chronic prostatitis is generally somewhat cloudy, owing to the presence of pus and epithelium from the prostatic region and sometimes also from the bladder. The many shreds and scrolls so commonly seen in this urine are shown on microscopical examination to consist of pus, epithelial cells, and some blood-cells held together by mucus. Among these shreds and scrolls are sometimes seen long cylindrical bodies which appear to be casts of the smaller prostatic ducts. Great quantities of octaedra of calcium oxalate are frequently found in the urine of these patients; at times lozenges of uric acid, at other times the urates in great abundance. Microscopic sympexia cast away from the prostatic crypts are often found in this urine, particularly in the case of elderly men.

A convenient method of obtaining pus from the prostatic sinus for microscopical examination is to introduce into the sinus of the urethral bulb a hollow, soft, No. 12 English bougie, with an acorn-shaped vesical extremity, with three or four perforations at the base of the acorn, and to syringe in four or five ounces of warm water for the purpose of washing away, by the retrograde current, the pus that may have accumulated in the spongy urethra. This accomplished, the bougie is carried onward as far as the urethro-vesical region and then withdrawn. The pus found coating the base of the acorn is then placed upon a glass slide, properly covered, and subjected to microscopic inspection. Mixed with this pus are many epithelial cells, perhaps some casts of the smaller prostatic ducts, and possibly a few sympexia, but no spermatozooids.

The first step in physical exploration is digital rectal examination. By this it is ascertained if the prostate be tender or insensible to the touch, hard or soft, decreased or increased in size, smooth or nodular; if nodular, whether the nodules be firm from organized plasma, doughy from purulent accumulation, tense from cystic formation, or of stony hardness from the presence of calculi.

The next step in this exploration is an examination of the urethra for the purpose of excluding urethral stricture, trachelocystitis, or vesical stone. Chronic prostatitis being sometimes the indirect outcome of urethral stricture, the urethra should be explored with a bulbous bougie to make sure of the existence or of the non-existence of stricture. The granular condition already referred to can be ascertained with the aid of the urethroscope.

The sharp pain at the urethro-vesical orifice during urination or at the moment of entrance into the bladder of a bougie or catheter indicates the complication trachelocystitis, which is so frequent that the coexistence of these affections has given rise to the term chronic prostato-cystitis. The persistent vesical pains simulate so much some of the symptoms of stone as to warrant an exploration of the bladder with a rectangular staff to clear any doubt in this respect. When the pain caused by the exploration is slight and confined to the prostatic region, the case may be regarded as uncomplicated chronic prostatitis.

The treatment of chronic prostatitis is varied in accordance with its different phases, complications, and consequences.

Uncomplicated chronic prostatitis attended with a flow of from a few drops to nearly a drachm of prostatic fluid during defecation, so common among continent men, and still more so among those addicted to masturbation, requires moral as well as local and constitutional treatment.

The moral treatment is the most difficult of the self-imposed tasks of the physician, who must employ much circumspection before he can pass judgment upon the needs of particular cases. In examining and advising any individual, he may exercise the greatest firmness, tempered, however, with patience, forbearance, and kindness. Thus he enlists the confidence of the sufferer, endeavoring to lead him to understand, first, that his local ailment is curable; second, that he is not suffering from seminal incontinence; third, that he is not impotent; and fourth, that he can not be cured unless he gives up the bad habits he may have acquired, and occupies his mind with subjects other than his ailments. When the patient is responsive to the moral treatment, more than half of the cure may be considered accomplished.

The local treatment of uncomplicated chronic prostatitis consists in irrigating the prostatic sinus once daily, with the object of washing away the mucus and pus which may have accumulated in the sinus and in the larger prostatic ducts. The fluid for irrigation should at first be a one-per-cent. watery solution of boric acid, using not less than four ounces of this solution for each irrigation. This often suffices in certain cases, but may be used with advantage as a preparatory step to more active measures when such are necessary. The manner of making this irrigation is to introduce a No. 8 or No. 9, English, uniocular, curved gum catheter into the membranous region of the urethra, and to slowly inject the fluid, which, passing through the prostatic urethra, dislodges and carries into the bladder the muco-purulent contents of the prostatic sinus. If any of the fluid flows out of the urethra beside the catheter, it is an index that the catheter has not reached the membranous region. In that case the instrument should be made to advance a little farther; then the injection surely enters the prostatic region and bladder. When the four ounces have been thrown in, the catheter is pushed into the bladder, whose contents are allowed to escape into a glass vessel to be examined for flocculi of muco-pus and epithelium, and to make sure that the cleansing process has been successful.

These irrigations are very effective also in the chronic prostatitis of elderly men. In many cases the prostatic sinus is filled by a plug of tenacious slime, which for hours is a source of irritation and of frequent prostatic spasms, until it is suddenly forced out by a stream of urine. The daily use of irrigations with the boric-acid solution almost invariably has the effect of breaking up this tenacious slime, or of preventing its accumulation. In case of granular urethritis of the spongy portion, it is wise to irrigate the whole canal. When these simple irrigations are insufficient to relieve the local distress, the use of steel sounds of increasing size has the double effect of dilating the canal and, by compression, of causing the granulations to disappear. The sound should not be passed oftener than twice each week. In conjunction with this process of dilatation, every third or fourth day the prostatic region of the urethra should be irrigated with a solution of nitrate of silver, one grain to the ounce, increasing its strength at subsequent sittings to two, three, and even five grains to the ounce of distilled water, and using only one ounce of the solution. The bladder should contain a few ounces of urine, so that the nitrate of silver may be decomposed and rendered harmless to its mucous membrane. The method of Guyon, by the instillation of five, ten, or twenty minims of nitrate-of-silver solution, from five to thirty grains to the ounce, is also employed in chronic prostatitis, but the use of a larger quantity of a weaker solution, such as one ounce, is preferable, as the fluid has a better chance of entering the prostatic ducts, and it is not desirable that the strength of the solution exceed five grains to the ounce. Before making the injection the prostatic urethra should be well cleansed with pure water. The immediate effects of the injection are a severe burning pain in the prostatic region and frequent and almost irrepressible urination, lasting an hour or two hours. There may even be a slight hæmorrhage, which, however, soon ceases. Afterward the muco-purulent discharge is much increased, but lessens and nearly disappears in two or three days. It sometimes happens that after the first or second injection of nitrate-of-silver solution there are no longer any manifestations of chronic prostatitis, but, as a general rule, several injections are necessary to effect a cure.

Other substances have been used in solution for irrigation in chronic prostatitis, such as mercuric or zinc chloride, copper or zinc sulphate (five grains to the ounce), resorcin, otherwise known as metadioxybenzol (ten grains to the ounce), but they are not equal to nitrate of silver in solution of moderate strength, the great advantage of nitrate of silver being that it is decomposed and becomes innocuous as soon as it has caused coagulation of the albumin of the superficial layer of epithelial cells.

In some cases of chronic prostatitis, owing perhaps to a slight imprudence or error in diet, the urethral discharge greatly increases, becomes creamy, simulating acute virulent urethritis. There are inordinate frequency and pain in urination, and a train of symptoms which are very apt to mislead the inexperienced. Such patients should not at first be subjected to local treatment, as it would be likely to aggravate the phlegmasia and cause some serious complication. Three or four days of rest and the free use of diluent drinks generally suffice to cause the cessation of all these phenomena. Then the local treatment may with safety be applied.

It is scarcely necessary to say that no success in treatment can be attained in complicated cases unless the complication is treated at the same time. If chronic cystitis exists, it demands special local treatment; if a urethral stricture should be detected, dilatation, divulsion, or urethrotomy might be required. If painful hæmorrhoids or anal fissures are the complication and perhaps also the cause, they should be appropriately treated. When prostatic calculi have already formed, they should, if possible, be removed without delay.

In those cases attended with constant dull pain in the perineal region and tenderness of the prostate it is proper to use counter-irritants for five or six weeks. Painting the perinæum with strong tincture of iodine, first on one side of the rhaphe, then on the opposite side, every two or three days, often answers the purpose; otherwise vesicating collodion may be similarly applied, avoiding the scrotum and anus, and covering the vesicated part with a thick layer of absorbent cotton. Suppositories of opium and belladonna may be occasionally used to relieve pain.

Small cysts or abscesses of the prostate may be tapped, by way of the rectum, with a small trocar and irrigated with peroxide-of-hydrogen solution.

Constitutional medication is necessitated by the generally impaired health of most sufferers from chronic prostatitis, and this medication is subject to such variations as may be indicated by the characters of the constitutional manifestations. The use of bitter tonics in conjunction with an improved diet is likely to sharpen the appetite and facilitate digestion. Active treatment for hyperlithuria may be necessary. Iron and quinine are of value as reconstituents. Laxatives soon have the effect of preventing fæcal accumulation, and afterward equal parts of tincture of chloride of iron, tincture of cantharides, and fluid extract of ergot, given in doses of ten minims twice daily, complete the internal medication. Then frequent general bathing followed by frictions, and increasing exercise, comprise the hygienic measures.

BULBO-URETHRAL ADENITIS. — Before examining the phlegmasic processes to which the bulbo-urethral glands are subject, some points in their history, special anatomy, and physiology may with profit be studied. These glands, the analogues of the vulvo-vaginal glands, were discovered by Méry, and a very brief description of them was inserted in the *Journal des savants*, June, 1684. Fifteen years after this, in 1699, Cowper published, in the *Philosophical Trans-*

actions, a note on these glands, and in 1702 gave of them a detailed description, and they have since borne his name. Several other anatomists laid claim to their discovery and each gave them a new name, such as little prostates, accessory prostates, inferior prostates, antiprostates, etc. In 1849 Gubler published, as his inaugural thesis, an exhaustive study of the anatomy and the phlegmasiæ of these glands, and adopted for them the name of bulbo-urethral glands on account of their site. They consist of a pair of compound racemose glands encapsulated by fibrous tissue, situated behind the urethral bulb, between the two layers of the triangular ligament, in the substance of the ischio-urethral muscle, and beneath the membranous portion of the urethra. They are generally about one millimetre on each side of the median line, but sometimes in contact. They are globular, discoid, or ovoid in form, and from five to eight millimetres in mean diameter. In the fœtus they are proportionately much larger than in the adult. In some of the lower animals, as the *Rodentia*, they are very large. In color they are pinkish yellow, in consistence firm and elastic.

In structure they are similar to the racemose glands and consist of roundish cellules, ranging from the one six-hundredth to the one three-hundredth of an inch in diameter, grouped around small ducts after the manner of bunches of grapes, the whole being bound by connective tissue and capillary blood-vessels. The cellules and ducts are lined by a cubical epithelium. The ducts of several primary lobules unite and form larger ducts which end in a common excretory duct.

Each gland has a single common excretory duct which emerges from the anterior extremity of the gland. This excretory duct varies in length from three to six centimetres, and in diameter from a quarter of a millimetre to one millimetre. As it emerges from the gland, this duct enters the substance of the urethral bulb and traverses it obliquely from behind forward for the space of one centimetre, where are found the accessory lobules which led Cowper to believe in the existence of a third gland. The duct then takes a nearly longitudinal course underneath the urethral mucous membrane for a distance varying from two to five centimetres and ends in a very narrow orifice beside the median line a little in advance of its fellow, the two very rarely having a common orifice. This orifice is sometimes so small as scarcely to admit a hair. It is generally very difficult and often impossible to find this orifice even in carefully dissected fresh specimens. The mucous membrane of the ducts is surmounted by a cubical epithelium resting upon a thin membrane surrounded by longitudinal and circular bands of smooth muscle tissue to be found also among the divisions of the duct in the substance of the gland.

The secretion of the gland in the natural state is colorless and viscid, and in pathic states becomes opaline or even markedly turbid, without, however, losing its viscidity. This secretion, whether in health or in disease, is much more consistent than that of any of the uro-genital glands, and it is this consistence which distinguishes it so well from the others. This viscidity of the mucoid fluid is such that it is easy to draw it into threads from ten to fifteen centimetres in length. It is of alkaline reaction, and when rubbed has the property of frothing like soap-suds.

These glands are annexes of the genital as well as of the urinary apparatus. As genital organs, their secretion, profuse at the beginning of the act, serves to lubricate the glans penis to facilitate intromission, and, continuing during the act, serves to dilute the semen. As urinary organs, their secretion is among those designed to lubricate, and so protect the urethral mucous membrane.

Bulbo-urethral adenitis—phlegmasia of a bulbo-urethral gland—is ordinarily the outcome of urethritis, but may also arise in consequence of a blow upon the perinæum or of an injury of the gland's duct by the accidental penetration of a capillary bougie. The left seems to be more commonly attacked than the right, and very exceptionally are both glands affected. The phlegmasia may be acute or chronic. In the great majority of cases the acute type resolves in a short time, suppuration being a rare termination. The chronic type is more frequent than it is generally supposed to be, and often constitutes one of the varieties of chronic urethral discharge. Observation of this chronic discharge, with induration and enlargement of the glands led Cowper and several of his contemporaries to believe' that "gonorrhœa" was often caused by phlegmasia of the bulbo-urethral glands, whereas this phlegmasia is in reality one of the occasional consequences of "gonorrhœa."

Acute bulbo-urethral adenitis consequent upon acute urethritis is often overlooked, because the perineal pain and tension which so frequently occur on the second, third, or fourth week of urethritis are not rightly interpreted, or not considered worthy of attention, or perhaps they are attributed to a purely neurotic condition, and the cessation of the pain is believed to be due to the remedies that may have been administered, whereas, in the majority of cases, the pain ceases owing to rapid resolution of the phlegmasia.

The subjective symptoms of this mild type of bulbo-urethral adenitis are painful tension in the perineal region on the affected side, tenderness to pressure while the patient is in the sitting posture, pain during walking exercise, from friction by the clothing, and more or less burning sensation in the region of the urethral bulb.

The objective symptoms are slight tumefaction corresponding to the situation of the gland, which, though hard and increased in volume, is movable; moderate compression of the gland with the finger, causing more or less pain, which is propagated to the urethra. There is no febrile reaction, no redness of the skin.

The progress of acute bulbo-urethral adenitis is ordinarily very rapid. As a general rule, resolution begins in a few days. Otherwise, suppuration is established in the course of ten days or, at most, two weeks. The phlegmasia, at first confined to the gland, finally extends beyond its fibrous capsule and into the ambient connective tissue, and there is peri-adenitis. Then the gland can no longer be felt, for it lies in a pus cavity. The abscess sometimes encroaches upon the opposite side, and extends forward to the scrotum. The skin is œdematous, becomes red, then livid in the center of the swelling, and at length ulcerates and gives issue to the pent-up pus, and later, perhaps, to urine, unless timely surgical aid had been obtained. The beginning of the suppurative process is known by febrile reaction, throbbing perineal pains, and increase of tenderness and tension.

Among the consequences of neglected bulbo-urethral adenitis are retention of urine from mechanical compression of the urethra by the abscess, perforation of the urethra and urinary fistula, and obliteration of the excretory duct of the gland.

The diagnosis is easy during the period of increase of the phlegmasia. The situation of the swelling, its mobility, its tenderness, viewed in conjunction with the history of the case, demonstrate the existence of bulbo-urethral adenitis. But when peri-adenitis is superadded, it may be confounded with urinary or simple abscess or a boil. Here, again, the history of the symptoms comes in aid to make certain the true nature of the swelling. If, after the abscess has been opened, a fistula persist for months and discharge a very viscid fluid, particularly at the beginning of sexual contact, it may be asserted with confidence that this fistula springs from the gland or from its duct, which may be obliterated at its anterior portion. A fistula giving issue also to urine indicates perforation of the urethra.

The treatment of acute bulbo-urethral adenitis during its period of increase should be antiphlogistic, consisting in the application of half a dozen leeches to the perinæum after which the ice-bag is to be used for three or four days. If at the expiration of that time resolution has not begun, the swelling and tension have increased, and the pain is throbbing, an incision should forthwith be made into the substance of the gland. The patient is placed in the lithotomy posture, a narrow, straight bistoury is plunged into the swelling at its most prominent point, and the wound is enlarged to half or three quarters of an inch in withdrawing the instrument. A few drops only of pus or none may flow, but the tension will have been relieved and perforation of the urethra prevented by this timely incision, without which it is almost certain to occur. As soon as the incision is made the cavity of the abscess should be irrigated with peroxide-of-hydrogen solution until the returned fluid is clear. The wound is then dressed antiseptically. Under favorable circumstances cicatrization is complete in the course of ten days. In the case of an abscess containing an ounce or two of pus there is very likely perforation of the urethra, and the healing process is necessarily long. To insure cicatrization, the patient is not allowed to urinate except through a catheter. In the case of a persistent fistula springing from the bulbo-urethral gland or its duct, attempts have been made to stop the flow of viscid mucus by injecting through the fistulous orifice different fluids designed to impair the structure of the gland, such as nitrate of silver, tincture of iodine, etc., but generally without success. Excision of the gland was proposed by Gruget, but it does not appear that he has ever performed this operation, which, from the situation and relations of the gland, would present no great difficulties, and which is justifiable in view of the facts that the affected gland is of no further use, and that the constant discharge of the viscid mucus is a source of no little annoyance to the patient.

VIII.

URETHRITIS; ITS NATURE, CAUSES, AND DIAGNOSIS.

URETHRITIS, the most common of all the affections of the uro-genital apparatus, is a phlegmasic process, beginning generally in the mucous membrane of the urethra and ordinarily characterized by pain, ardor, dysuresis, and a more or less abundant muco-purulent discharge. In many cases it is contagious, but in the great majority it is non-contagious.

This phlegmasia was named urethritis, in the year 1802, by Bosquillon, because he regarded the word urethritis as expressing the locality and the phlegmasic character of the disease, and "gonorrhœa and blennorrhagia" as failing to convey the idea that the urethra is in a state of phlegmasia; the one meaning a flow of semen and the other a breaking forth of mucus. Therefore it was that he followed the example of Sauvages in the use of the suffix *itis* to denote phlegmasia, and accordingly constructed the word urethritis to express a correct idea of the nature and seat of the affection, *i. e.*, a phlegmasia of the urethra.

"*Gonorrhœa*" *is the most ancient of the designations of this disease*, and was used because of the supposition that the discharge was semen and originated in the seminal vesicles; and this erroneous designation is still used almost universally, although it is more than three centuries since urethritis was distinguished from the so-called gonorrhœa.

In the sixteenth century Ambroise Paré spoke of gonorrhœa as an involuntary discharge of semen, and of *chaudedisse* (clap) as a purulent discharge which he believed to originate in the seminal vesicles or, at least, in the prostatic region of the urethra. William Cockburn was the first English author to assert that "gonorrhœa" was seated in the urethral mucous membrane and not in the prostate or seminal vesicles. The first edition of his work, *On the Symptoms, Nature, Causes, and Cure of Gonorrhœa*, appeared in London in the year 1713, and the fifth edition in 1728. Many physicians who are acquainted with these facts still persist in speaking of the flow of pus in urethritis, in vulvitis, and in vaginitis, as "gonorrhœa," which means nothing more than a running of semen, because, they urge, the term has been sanctioned by long usage. Because an error has been reiterated for three thousand years or more assuredly does not make it less an error, and the long existence of this evil in language is certainly no argument in favor of sanctioning its continual perpetration. Otherwise, how great would be the inconsistency of those who are striving to bring the science of medicine to its proper level in this nineteenth century of progress!

"*Blennorrhagia*," an outbreak of mucus, was first employed by the Austrian, Swediaur, in the latter part of the last century, in preference to "gonorrhœa," which, as he says, implies a flow of semen, while in reality nothing of the kind ever occurs in this disease. But the word "blennorrhagia" fails to indicate that the urethra is in a diseased condition. Even if the adjective urethral were always prefixed to "blennorrhagia," the two words would also fail to convey the idea of phlegmasia of the urethra. Although many different words have been proposed as substitutes for these two obviously inaccurate terms, the French still adhere to "blennorrhagia," which they originally borrowed from the eminent Austrian syphilographer.

"*Venereal catarrh*" is another expression now commonly used, in Germany and other countries, instead of "gonorrhœa." It was suggested in 1806 by Capuron, a Frenchman. Venereal catarrh of what particular part or mucous membrane of the body does not appear in the expression. But catarrh means simply a downward flow, not even a flow of mucus. Therefore catarrh fails to designate the true character of urethritis.

It is often asked, Is not "gonorrhœa, or blennorrhagia, or venereal catarrh" something more than a phlegmasic affection? Sometimes it is, and in that case there is urethral chancre, chancroids, or mucous patches—otherwise, "gonorrhœa, blennorrhagia, and venereal catarrh" have never conveyed to the mind of any thoughtful reader and investigator the faintest notion of phlegmasia, and to such the only meaning they express is a flow of semen in the first case, an outbreak of mucus in the second, and a downward flow from venery in the third case. It is asked also with equal frequency, Is there not high authority for saying that the terms "gonorrhœa, blennorrhagia, and venereal catarrh" should be applied to that form of disease which is contagious, and urethritis to that which is non-contagious? Yes, high authorities have made the assertion, without agreeing which of the first three terms should be used; but when high authorities misuse words there is no obligation to follow their bad example.

Many other names have been proposed to take the place of "gonorrhœa"; among them, arsura, pyorrhœa, and syphiloid. The latter was used for a time by Ricord. None of these names had a long survival, for they were most unfit. But "gonorrhœa, blennorrhagia, and venereal catarrh" are, so far, examples of the survival of the unfittest. It is to be hoped that urethritis, answering as it does all present needs and indicating so clearly the phlegmasic character of the disease in the male, as do vulvitis and vaginitis in the female, may survive all those unfit names that always give a wrong impression if they convey any idea whatever. Arsura was spoken of by John Ardern (1320 to 1370) as an interior heat with excoriation of the urethra, and he spoke of this same arsura as occurring in the genitalia of women. Arsura was also used as synonymous with erysipelas. The popular saying, "He was burnt" (meaning that he contracted venereal disease), is likely to have originated from the old word arsura, which was apparently technical in the fourteenth century and coined from *ardere*, *arsum*, to burn, burnt.

The names given to urethral phlegmasia by the vulgar of several nations in some respects are more appropriate than those employed by the medical profession. These names, based upon different manifestations, are surely not worse than "gonorrhœa, blennorrhagia, or venereal catarrh." For example, the common people of England and of this country call urethritis *clap*, the French *chaudepisse*, the German *Tripper*, and the Spanish *purgación*.

Clap is derived from the old French *clapier*, which means a burrow, a hiding place, and is often applied by surgeons to burrowing abscesses. It means also a filthy place, a hovel, or brothel. The term clap may have been adopted on account of this meaning of *clapier*—a hovel or brothel where dwelt the women from whom the disease was supposed to be contracted, or perhaps on account of the filthy condition of the genitalia of these women.

Chaudepisse was suggested by the great scalding which is experienced in urination during the second or stage of increase of urethritis. For the milder cases the people use the terms *échauffement*, heating, and *coulante*, running.

Tripper is taken from *trip*, which means to drop or drip, and has reference to the dripping of the pus from the urethra.

Purgación, from *purgare*, *purgatum*, to cleanse, has reference to the abundant discharge, which the vulgar imagine "cleanses the system of a humor." It may also have reference to the fact that it is sometimes contracted from women during the menstrual period, for the people call the menses *purgaciones*, which they take literally from the Latin.

Antiquity of Urethritis.—There does not appear to be any historic period when urethritis was unknown. Dujardin and Peyrihle, in the history of surgery from its origin to their day, speak of the great frequency of "gonorrhœa" in the East, and in alluding to the operation of "circumcision," which was employed partly to prevent venereal disease, trace the origin of this operation to a period antecedent to the time of Abraham. Moses very clearly points out "gonorrhœa" as existing in his time, and his sanitary laws tending to its prevention are admirable, and, if followed to the letter, would unquestionably lead very materially to the decrease of the disease. Hippocrates, Galen, and Celsus discourse upon this disease and its causes, and nearly all the medical writers of the middle ages make reference to urethritis.

THE NATURE OF URETHRITIS was long in dispute, and the question, Is it an infectious disease, a simple phlegmasic process, or a contagious affection *sui generis?* was earnestly discussed by able physicians, whose conclusions were so diverse that, for convenience, they were classed and designated as the identists and the non-identists. The identists were those who asserted that "gonorrhœa" and syphilis are identical diseases, *i. e.*, that "gonorrhœa" and chancres are produced by one and the same virus, and that "gonorrhœa" can produce chancres and *vice versa.* The early authors who treated of syphilis were not identists—that is to say, they made a distinction between the "simple chancre," the infecting chancre, and urethritis, and it was not until about the middle of the sixteenth century that the distinctions of these three diseases ceased, and that the doctrine of identism was promulgated by Musa Brasavola, of Ferrare, and generally accepted. This doctrine continued in vogue until the latter part of the eighteenth century, and was first questioned by Balfour (1767), then by Tode, of Copenhagen (1777), and by Fabre, a disciple of the renowned Petit, who showed that he had doubts upon the question of identism when he asserted that the consequences of "gonorrhœa" were not the same as those of chancre. The first edition of his work on venereal diseases was published in 1758. Hernandez, of Toulon, a surgeon of the French navy, published, in 1812, a monograph of 348 octavo pages to establish the non-identity of the "gonorrhœal and syphilitic viruses."

The answer that may now be made to the question respecting the nature of urethritis accords with neither that of the identists nor that of the non-identists, which are so extreme, but includes all that seems rational from each side, *i. e.*, urethritis is, in all cases, a phlegmasic process. It is often contagious, but most frequently it is simple, non-contagious. It is contagious but non-infecting when it arises from urethral chancroids; it is styled virulent when it arises from the contagium of virulent vulvitis or vaginitis, and it is infecting when due to urethral chancres or mucous patches. It is not auto-inoculable when simple or when due to an infecting chancre. It is auto-inoculable when owing to a non-infecting chancre, called chancroid by Clerc.

John Hunter was at the head of the identists, and Benjamin Bell ably and eloquently pleaded the cause of the non-identists. Hunter declared that "gonorrhœal" virus was capable of producing chancre and chancrous virus of producing "gonorrhœa." The great master endeavored to settle this question in the month of May, 1767, by making an inoculation upon the prepuce and another upon the glans penis with pus taken from the urethra of a patient whom metres in length. It is of alkaline reaction, and when rubbed has the property of frothing like soap-suds.

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Acute bulbo-urethral adenitis consequent upon acute urethritis is often overlooked, because the perineal pain and tension [illegible] [illegible] frequently occur in the second, third, or fourth week of gonorrhoea are not rightly interpreted, or not considered worthy of attention; or perhaps they are attributed to a purely neuralgic condition, and the cessation of the pain is [illegible] [illegible] to the remedies that may have been administered, whereas, in the majority of cases the pain ceases with the rapid resolution of the phlegmasia.

The subjective symptoms of this mild type of bulbo-urethral adenitis are painful tension in the perineal region on the affected side, tenderness to pressure while the patient is in the sitting posture, pain during walking [illegible] from friction by the clothing, and more or less burning sensation in the region of the urethral bulb.

The objective symptoms are slight tumefaction corresponding to the situation of the gland, which, enlarged, [illegible] and increased in volume, is movable: moderate compression of the gland with the finger, causing more or less pain which is propagated to the urethra. There is no [illegible] reaction, no redness of the skin.

The progress of acute bulbo-urethral adenitis [illegible] narily very rapid. As a general rule, [illegible] [illegible] few days. Otherwise, suppuration [illegible] course of ten days or, at most, two weeks. [illegible] at first confined to the gland, finally [illegible] fibrous capsule and into the ambient [illegible] there is peri-adenitis. Then the gland [illegible] felt, for it lies in a pus cavity. The [illegible] encroaches upon the opposite side and [illegible] he believed to be affected with "gonorrhœa." There resulted two chancres which were followed by constitutional syphilis. He therefore concluded that the two diseases proceeded from the same virus. A detailed account of this event with its ultimate result is given by Hunter in his treatise on *The Venereal Disease*, London, 1788, pp. 324–327. It now seems fair to assume that the urethral pus used in this experiment was the product of a syphilitic sore of the urethra.

Benjamin Bell took a diametrically opposite view of the subject, and, to overthrow the doctrine espoused by Hunter, made an elaborate and strong argument, abundantly illustrated by cases, in which his final conclusion was, that the pus of chancre could never produce "gonorrhœa" and that the pus of "gonorrhœa" could never produce chancre. This argument, contained in the first chapter of Bell's work on *Gonorrhœa virulenta and lues venerea*, 1793, entitled the consideration of the question whether "gonorrhœa" and lues venerea originate from the same contagion, is well worthy of careful perusal by those who may wish to investigate the question.

Both eminent observers had their adherents, who warmly and ably argued the question which, many years after the death of the two contestants, continued to be discussed. It was finally settled by the concurrent labors of three earnest workers in this field of medicine—namely, Ricord, Bassereau, and Cullerier—but they shall now speak for themselves through the last named, who expresses their ideas substantially as follows: Ricord, who has made inoculations of venereal matter on the largest scale, has come to the conclusion that simple urethritis is never inoculable, that is to say, produces no specific sore, but that when a specific sore results from inoculation with urethral pus it is because there exists in the urethra a chancre which had escaped detection. But these observations, which at first sight seemed to throw such great light upon the question, have lost much of their value since the publication of the work of Bassereau, before which Ricord believed that chancre and syphilis were the same thing. From an exhaustive and conscientious clinical study of the subject, Bassereau was forced to conclude that all chancres were not of the same nature ; that whenever there were syphilitic symptoms, these had been preceded by an indurated chancre ; that the indurated chancre has always originated from another indurated chancre ; and that a soft chancre has always been due to another soft chancre and never caused syphilis. Cullerier at first combated these ideas, as he had, though rarely, seen constitutional symptoms follow soft chancres ; and it was not until the year 1857 that Ricord accepted the doctrine of Bassereau. In endeavoring to establish the differential characters of the two chancres, Ricord offered the following proposition: the soft chancre is inoculable for an indefinite period, while the indurated chancre can scarcely ever be inoculated—on the infected individual of course. This is a direct contradiction of his original proposition, which was to the effect that what distinguishes virulent urethritis, urethral chancre, from simple urethritis is that the former is inoculable, and that whenever the inoculation is negative in urethritis there is no syphilis. On the other hand, Ricord maintains that the indurated chancre alone gives syphilis and is rarely, if ever, auto-inoculable, and that the soft chancre has the property of being inoculated upon the sufferer. Therefore, says Cullerier, whenever an inoculation is made with the pus of urethritis, if this inoculation be successful, it is to be concluded that there exists in the urethra a soft chancre and that there will not follow any constitutional symptoms. If the inoculation is negative, this will afford no proof whatever that there will not follow constitutional symptoms, inasmuch as the indurated chancre rapidly loses its property of being inoculated.

From these statements of the case it is plain that what has been said of the value of inoculation to serve in distinguishing the two species of urethritis should be blotted out, or at least should be given another signification, for it is evident that the most inoculable is the least dangerous. The evidence furnished by inoculation is therefore not to be absolutely depended upon in the distinguishing of simple, chancrous, and chancroidal urethritis. The more rational and tenable position in regard to the nature of urethritis, so far as it is related to chancre and chancroid—and this position is based upon a careful analysis of the propositions of both the identists and non-identists and upon clinical observation—is that urethritis may be simple, or contagious, or it may be the consequence of a non-infecting, or of an infecting chancre, either of which being accidentally situated in the urethra, and acting, so far as the urethra is concerned, as a local irritant. The primary lesion of syphilis *per se* possesses no inherent property which, other than as a local irritant, may cause urethritis, the two diseases being entirely distinct. The same may be said of the third disease, the non-infecting chancre. From what precedes it may be concluded that a man can contract urethritis from a woman who has a chancre, chancroids, or mucous patches of the genitals. Many experienced and sound observers have encountered cases of urethritis so contracted, and the patients have not had the slightest indication of chancre or chancroids. Cullerier thus explains the phenomenon: In the primitive ulcer there are two things—a phlegmasic product and something special; therefore the individual may take that only which is simply phlegmasic and escape syphilitic or chancroidal infection, the pus acting only as an irritant. He quotes, from Benjamin Bell's work, the case of a medical student who placed some chancrous pus between the glans penis and prepuce, and this caused a simple balanoposthitis, while others, after introducing chancrous pus into the urethra, had only non-virulent urethritis.

It has happened that, from the same woman, a man has contracted a chancre on the glans penis, and nothing else, and that another man, almost immediately after, has only caught a simple urethritis. It has also happened that a man has contracted, from one woman, a "gonorrhœa," an infecting chancre, and non-infecting chancres; the woman being affected with all three diseases.

It may now be said that the proposition, contained in the answer to the question respecting the nature of urethritis, is sustained and may be summed up as follows: Urethritis may be non-contagious, it may be contagious and non-infecting, or it may be due to the presence in the urethra of an infecting or of a non-infecting chancre, and the same patient may contract a non-infecting urethritis simultaneously with a chancre or a chancroid in the urethra. This may have happened in the case cited by Hunter to prove the identity of the two diseases.

CAUSES.—Urethritis is said to be infecting when due to the presence of an infecting chancre or of a mucous patch in the urethra. It is non-infecting when owing to a urethral chancroid. It is named virulent when it arises from a contagium capable of reproducing itself indefinitely under proper conditions, as exemplified in the cases of urethritis commonly designated "gonorrhœa," contracted from virulent vulvitis or vaginitis, or by mediate contagion. It is called simple when non-contagious, whether originating from sexual commerce or from local irritants.

Infecting urethritis is followed by distinct manifestations of syphilitic infection in the course of from six weeks to three months. The physicians who judge from observation of the effect of chancre at the urinary meatus deny that urethritis is produced by urethral chancre, for in such cases there is little if any tendency to the backward extension of the phlegmasic action, which is commonly of short duration, and the mucous membrane of the urethra behind the sore remains intact. That a chancre seated within the urethra does produce urethritis was exemplified by John Hunter's well-known experiment. The urethritis caused by a urethral chancre, besides generally being slight and of short duration, is accompanied by little or no pain during urination. A case of urethritis which gets well, without treatment, in a week or in two weeks, needs to be viewed with suspicion and to be kept under close observation for at least three months.

The following is given in illustration of the clinical history of a case of infecting urethritis: The patient, finding it necessary to invoke medical assistance owing to certain symptoms which had caused him some anxiety, gave a part of this account of his complaint. Three months before he had contracted for the first time what he supposed to be an ordinary urethritis which gave him very little inconvenience and was well in a week. He had never had any other venereal disease. There was no visible sore or scar upon any part of his sexual organs. In the course of six weeks after the cessation of the urethral discharge he had a well-marked roseola, which was observed by a medical officer of the navy, and in six weeks more—that is, three months after the disappearance of the urethritis, when he applied for treatment—he was suffering from mucous patches in the fauces, and showed other unmistakable symptoms of syphilis. When this supposed simple urethritis began he was at sea (had sailed from New York several days before), and for the next eighty days was on board a man-of-war and in no way exposed to the contagion of syphilis. Assuming the veracity of the patient's story, it is fair to conclude that his urethritis was caused by an intra-urethral chancre.

Urethritis due to mucous patches in the urethra, though of rare occurrence, has been repeatedly verified by careful observers. It is characterized by a discharge which is at times sanious and which continues as long as the mucous patches exist. During urination there is some scalding pain. A patient who has never contracted urethritis, but after impure sexual commerce becomes infected with syphilis and, several months after the initial lesion, is affected with mucous patches in the fauces and a purulent sanious urethral discharge, may fairly be regarded as suffering from urethritis due to the existence of urethral mucous patches, provided that, in the mean time, he had abstained from sexual commerce.

Non-infecting urethritis due to urethral chancroids is not followed by lesions such as those which characterize the infecting, syphilitic variety, but it has its own special virus which acts locally and possesses the property of reproducing itself indefinitely in proper soils. The same observers who deny that urethral chancre produces urethritis also assert that chancroids do not give rise to this phlegmasia, and probably for the same alleged reason. That chancroids of the urethra do cause urethritis is a fact which few physicians now dispute. These chancroidal ulcers are prolific sources of cicatricial strictures in the fossa navicularis and even in the phallic region of the urethra. Chancroidal urethritis continues until the ulcer is healed and sometimes long after the healing process. The discharge is often profuse and sanious. When a doubt arises as to its nature, the question is decided by inoculating with it the patient.

By virulent urethritis, improperly styled "gonorrhœa," *is meant* the urethritis resulting from sexual contact with a person suffering from a species of vaginitis or vulvitis characterized by a purulent discharge capable of reproducing itself, even when applied artificially to any of the mucous membranes that are susceptible to venereal phlegmasia.

The mucous membranes which are most susceptible to venereal phlegmasia are those of the glans penis, the prepuce, the urethra, the prostatic utricle, the urethral crypts, the anus, the mouth, and the conjunctiva.

The mucous membranes which are refractory to venereal phlegmasia are those of the ducts of the bulbo-urethral glands, the prostatic ducts, the ejaculatory ducts, the seminal vesicles, the spermatic canals, the bladder, the rectum, the nose, and the lacrymal canals.

Bonnières, who has compared the histological characters of these two groups of mucous membranes, describes the first as being supplied with papillæ and covered with pavement epithelium, with an underlying network of lymphatic capillaries whose parietes are constituted by epithelial cells, while the second group is covered by cylindrical epithelium with an underlying network of red blood-capillaries instead of lymphatics, and concludes that the venereal phlegmasia acts primarily upon the lymphatic capillaries and the epithelium, and that the phlegmasia of the neighboring tissues is only secondary thereto. In the prostatic region, for instance, there is a close subepithelial network of lymphatic capillaries which anastomose with the lymphatic capillaries of the spongy portion of the urethral mucous membrane and terminate abruptly at the urethro-vesical orifice, the bladder mucous membrane being entirely destitute of lymphatics; hence it is that the bladder is refractory to phlegmasia such as might otherwise be propagated through the urethra (Perrin).

THE NATURE OF THE CONTAGIUM OF URETHRITIS.—It has been asked what evidence is offered in support of the assertion that there is such an affection as a *sui-generis* virulent contagious urethritis? Many writers have endeavored to answer this question; among them, Dr. Thiry, of Brussels, and Mr. Hutchinson, of London.

Dr. Thiry enumerates three kinds of urethritis—the first, simple; the second, syphilitic; and the third, having a virus of its own which he calls the granulous virus, and which, he says, is the distinctive character of true contagious urethritis whose morbid elements are granulations. But granulations exist in the vagina and cervix uteri in many women who seldom give urethritis to men who are accustomed to lie with them or, to use Ricord's expression, whose genital organs are acclimated. This fact is undeniable, and overthrows Dr. Thiry's doctrine. If Dr. Thiry's views were correct, urethritis should be the rule and not the exception in these cases.

According to Mr. Hutchinson, the contact of dead pus, whose corpuscles are in an advanced state of fatty degeneration, such as that from an abscess, causes but little irritation, while living pus, recently formed, is contagious and likely to cause phlegmasia when in contact with tissues similar in structure to those whence it originated. But this also fail to establish the character of the contagium said to be peculiar to non-infecting contagious urethritis. In accordance with the light thrown, of late years, upon phlegmasic processes, pus consists of dead leucocytes that have failed to destroy the morbific materials they have attacked; therefore there are no living pus-corpuscles. Pus is a dead substance to be ejected or encysted and rendered innocuous until transformed. That urethritis is often contagious is fully and frequently demonstrated clinically. A man affected with acute non-infecting virulent urethritis who deposits his urethral pus into the healthy vagina of a woman contaminates this vagina, and there follows vaginitis, and this same vaginitis causes urethritis in another man who exposes himself to the contagion. What, then, is the element of contagion, and where does it reside? Is it in the pus-cell, in the serum of the pus, or in the mucus contained in the morbid discharge? These questions have not yet been satisfactorily answered, although several theories have been advanced respecting the nature of the contagium, the latest being the microbic.

Among those who regard the contagium of urethritis as microbic is Dr. F. P. Jousseaume, who, in his inaugural thesis on the vegetable parasites of man, Paris, 1862, describes an alga of urethritis, to which he gives the name of genitalia, and whose habitat, he says, is subepithelial. He believes urethritis, as well as vaginitis, to be caused by the presence of this parasite. This is here recorded only as a part of the history of the doctrines relating to the contagium of urethritis.

Many of the modern patho-histologists assert that in the discharge of simple urethritis no micro-organisms are present, while in non-infecting virulent urethritis, "gonorrhœa," the pus-cells contain a specific diplococcus, named "gonococcus," and discovered in the year 1879 by Neisser. It is further asserted that whenever this contaminated pus is conveyed to the urethra there follows a urethritis with the reproduction of the "gonococcus" in the pus-cells of the new urethritis.

Since the announcement of Neisser's discovery several other organisms have been detected in the pus of virulent urethritis. In some cases of virulent urethritis no "gonococci" have been found, while in many cases of non-virulent urethritis "gonococci" abound.

Diplococci undifferenced morphically from "gonococci" have been seen repeatedly in pus from different parts of the body and in abscesses distant from the genital and urinary organs of patients in whom there were no traces of venereal disease.

It has been suggested that the contagium resides in the mucus of the urethral discharge, with the implication that this contagium may be a toxalbumin destructive to the epithelium. But whence this particular toxalbumin which selects the genitalia with such nefarious intent?

Since several different micro-organisms have been found in the pus of urethritis, may not any or all of these organisms be capable of acting as irritants, and give rise to supersecretion of mucus, to blood stasis, plastic exudation, the emigration of leucocytes, and exfoliation of epithelium;

some irritant being essential to the development of phlegmasia? Or is the irritant of urethritis likely to be a virulent ptomaine? This is certainly not impossible, since urethritis has been experimentally induced by the injection of dilute liquor ammoniæ.

Nothing so far discovered has sufficed to explain the nature of the contagium of that variety of urethritis miscalled "gonorrhœa."

By mediate contagion of urethritis is meant the transmission of the disease without coitus, but by contact with objects impregnated with the urethral or vaginal discharge of a diseased individual. The question of mediate contagion is of great consequence. Much ridicule has been cast upon it, and honest and veracious patients have often been discredited when they have declared that their urethral discharge was not the result of sexual commerce. Nevertheless, the possibility of contracting contagious urethritis mediately—that is to say, without sexual approach—is a fact which has been attested by excellent observers for a century past, and which was recognized even in the time of Moses, as indicated in Leviticus, chapter xv, verses 2, 3, and 4: "The man that hath an issue of seed shall be unclean . . . when a filthy humor, at every moment, cleaveth to his flesh and gathereth there. Every bed on which he sleepeth shall be unclean, and every place on which he sitteth." That patients contract purulent ophthalmia by using towels soiled by a person affected with contagious urethritis or vaginitis, or by the affected individual himself carrying a soiled hand to his eye, is of constant occurrence. What, then, is to prevent contagion if this pus be applied to the orifice of the urethra instead of the eye? That in these days patients do contract urethritis in unclean places without sexual contact is not a very uncommon occurrence, and that a healthy man sleeping in the same bed with a man suffering from contagious urethritis is liable to contract the disease is also a very reasonable assertion, as it is only necessary for an almost infinitesimal quantity of infected pus to make its way to the urethra to insure contagion, and contact with freshly soiled bed-linen during sleep is not unlikely. Nurses affected with contagious vaginitis or vulvitis have communicated purulent ophthalmia to infants in their charge entirely through soiled hands, and in the same way have given urethritis to children. Contagious urethritis engenders contagious vaginitis and *vice versa*. Such are among the ways in which the disease is propagated and perpetuated.

By SIMPLE URETHRITIS is meant a phlegmasia which has no specific virus and is not contagious, but which arises from the action of mechanical or chemical irritants to the urethral mucous membrane, from sexual excesses, from masturbation, etc. It is characterized by symptoms similar to those of virulent urethritis. It has the peculiarity that the phlegmasic process often begins in the prostatic, membranous, or perineal region of the urethra, and gradually extends forward, and finally invades the whole canal, but it also frequently begins in the fossa navicularis, extends backward, and is attended with nearly all the complications and sequels of the contagious form. In some cases there is much febrile reaction, and the discharge is very profuse; in other cases the urethritis is superacute, while in the majority it is subacute.

Gouty patients are sometimes affected with a purulent urethral discharge, which is often attended with scalding sensation during urination. This discharge usually disappears on the cessation of the gouty symptoms. In certain cases, however, the discharge lasts many weeks. Urethritis is frequently one of the first manifestations of an attack of gout, and thus shows itself each time the patient is newly attacked with "the gout." This occurs so commonly in some cases that the patients are able, two days before, to announce the advent of a gouty seizure, and they base their prediction upon the ardor urinæ, which they had noticed as so regularly preceding former attacks. The urine of these sufferers is loaded with uric-acid sand, and the ardor urinæ is caused by minute punctures inflicted upon the urethral mucous membrane in its whole extent by the sharp points of the uric-acid crystals. The mucous membrane thus wounded yields more or less blood, which passes away with the urine, and there soon follows a flow of pus which does not cease until the urine is free from crystalline matter. It sometimes happens that a number of uric-acid crystals are cemented together and form concretions of various sizes, from one to six millimetres in mean diameter, which, when carried along in the stream of urine, have been known to block up the urethra, cause retention of urine, and phlegmasia and even ulceration of the urethral mucous membrane. Several such concretions have been found lodged behind urethral strictures, causing retention of urine, besides a copious purulent collection.

Stone in the bladder, particularly the phosphatic, is sometimes an indirect cause of urethritis. The ammoniacal urine loaded, in such a case, with prismatic crystals, being extremely irritating to the urethral mucous membrane, at length causes a urethritis which, though subacute, is attended with inordinate sensitiveness of the canal.

Urethritis is known to arise from the ingestion of substances which, being eliminated by the kidneys, render the urine acrid and irritating. For example, the free and continuous use of asparagus as an article of food is not an uncommon cause of urethral phlegmasia. There are many persons who can not make use of this succulent delicacy for two or three consecutive days without being inconvenienced by a very considerable smarting sensation in the urethra during urination, and even by a purulent urethral discharge. Soon after eating asparagus, their urine emits a characteristic strong odor, and often contains innumerable crystals of oxalate of calcium, and this continues so long as they persist in indulging their desire for this luxury.

Among the many who have complained of the ill effects of asparagus is a young man who, during three consecutive summers, was annoyed by profuse urethral suppuration with much scalding in urination. On each occasion he believed himself affected with contagious urethritis, from which, however, he had never suffered, but during these periods he had been indulging very freely in asparagus. He was advised to abstain from this his favorite dish, and the discharge always ceased soon after his compliance with the advice.

New ale, beer, cider, and other fermented liquors, even when used in moderation, are known to excite urethritis. These beverages exert an evil influence upon the imperfect digestion of elderly men, and their use should be forbidden. The abuse of all alcoholic stimulants is a potent factor in the production of urethritis.

Free doses of cantharides given ignorantly or with malicious intent have led to the gravest consequences besides a free flow of pus from the urethra. Large Spanish-fly blisters applied to the trunk or extremities have been followed by the same ill effects.

Urethritis may be due to any obstruction which favors stagnation and fermentation of urine in the bladder. Those patients who have long suffered from obstructed urination caused by urethral stricture or prostatic enlargement, and, in consequence thereof, have been obliged to urinate with undue frequency, nearly all suffer from urethritis as a result of the great irritation produced by putrid, ammoniacal urine.

Urethral phlegmasia is sometimes the outcome of frequent or of violent catheterism. Sufferers from enlargement of the prostate, who are obliged to use the catheter four or five times daily to relieve their bladders, are, in the beginning, much inconvenienced by urethritis. In some cases the first catheterism excites an acute urethritis which renders subsequent catheterisms painful, but as it would be unwise to suspend the use of the instrument, measures are taken to mitigate the phlegmasia and relieve the pain, and they are ordinarily successful. Many cases could be cited where the first catheterism caused acute urethritis which, in a few days, yielded to rest and mild local treatment, and did not recur after the urethra had become habituated to the passage of the catheter. There are, however, many cases in which the urethral discharge becomes chronic and is maintained solely by the irritation to which the catheter gives rise, notwithstanding the most careful antiseptic precautions. In other cases, and unfortunately they are not few, the patients, from an unwise sense of economy, allow themselves to use worn-out, defective, or improperly constructed catheters, which seldom fail to cause local mischief. Others again, from carelessness or ignorance, use more or less violence, or catheterize themselves with undue frequency, and urethral phlegmasia, if not a more serious injury, is the almost invariable result.

When the external orifice of the urethra happens to be narrower than natural, and the patient is in the habit of catheterizing himself frequently and clumsily, there sometimes follows a phlegmasia of the extremity of the penis, with more or less induration, which renders the use of the instrument difficult and distressing. In a patient so affected, the induration had involved such a considerable portion of the glans penis that it was at first suspected to be of a malignant nature; but, after the more careful use of a smaller catheter and the local application of acetate-of-lead solution, the induration subsided, and the meatus was incised so as to allow the easy passage of ordinary-sized catheters.

Exploring catheterism, even with a sterilized instrument, may cause urethritis. The following is a fair illustration of this point: A., sixty-five years of age, who applied for treatment on account of an attack of acute urethritis, with copious purulent discharge, and was not as frank and outspoken as a patient should be with his medical adviser, betrayed so much anxiety as to the probable cause of his ailment and asked questions of such character as to lead his hearer to the surmise that he might have exposed himself to contagion. However, after the summing up of a considerable amount of cross-questioning, this did not seem likely. At length it was incidentally learned that he had been catheterized, with due precaution, a few days before, with a view of discovering the cause of obstruction to urination, of which he had been complaining. The instrument did not penetrate the urethral canal more than two inches, and in two days the discharge of pus had begun. A cautious exploration revealed a very narrow stricture in the phallic region of the urethra, and the conclusion arrived at was that, if the patient had illicitly indulged his sexual desire, he surely had not contracted virulent urethritis, but that the acute phlegmasia was the result of the catheterism perhaps violently practiced upon an already diseased and sensitive urethra. The discharge ceased a few days after the urethra was properly enlarged.

Foreign bodies of various kinds introduced from without into the urethra and retained for a certain length of time give rise to urethritis. Among these foreign bodies may be mentioned broken ends of catheters or bougies, fragments of wood or straw, pudendal hairs, and many other objects. Several cases of urethritis caused by the accidental passage of pudendal hairs into the urethra have been observed, the purulent discharge ceasing soon after the removal of these foreign bodies from the fossa navicularis urethræ.

A catheter retained a few days in the urethra excites phlegmasia of the mucous membrane, and has been known to cause ulceration at certain points, such as the navicular fossa, the peno-scrotal junction, and the bulbo-membranous region, particularly in those cases of urethral stenosis treated by continuous dilatation where the instrument is sometimes unwisely retained a week or two weeks.

Sexual excess appears to be the most common cause of urethral phlegmasia. Fournier expresses the opinion that by excessive sexual indulgence men give themselves urethritis oftener than they receive it. He further asserts that seventy-five per cent. of all cases of urethritis are non-contagious. The majority of women from whom urethritis is supposed to have been contracted had not vaginitis or, at least, had not contagious vaginitis or vulvitis. The urethritis so developed is, of course, simple, non-contagious. There are women whose vulvar and vaginal secretions are so acrid as to give urethritis to all those that have sexual commerce with them. A case often quoted in illustration of this point is that of a noted and very attractive courtesan, whose genital organs were in a perfectly healthy state, but who, nevertheless, gave urethritis to all the men who won her favor.

The occurrence of urethritis from sexual contact during, *immediately before, or too soon after, the menstrual flow*, or during the early period of lochial discharges, has been very frequently verified, and such urethritis, although ordinarily mild, is often as obstinate as it is severe, and is sometimes followed by many of the evils of virulent urethritis, but it is never contagious.

Urethritis is often caused by sexual contact with persons suffering from leucorrhœa, or from uterine cancer, or tuberculosis. Excessive sexual indulgence with a woman affected with leucorrhœa is likely to cause urethritis in the man, who, when he discovers his infirmity, is too apt to accuse of infidelity his partner in the sexual debauch. This has frequently happened in the case of the newly married and has led to connubial infelicity, to much misery, to ill treatment of the innocent wife, to divorce, and to utter ruin. Other sad consequences, particularly to an oversensitive man who may have been suffering from an old gleet, are self-accusation, despondency, and perhaps even suicide, under the erroneous impression that he had infected his wife with a "disease of which he was not properly cured." It is almost needless to say that chronic urethritis is not contagious.

The following case illustrates another point of medical and legal interest. A medical man who had been under treatment for faucial diphtheria went away alone for a few months, and shortly after his return called to say that he had urethritis, from which he had never before suffered. In two weeks he was well without having had recourse to the ordinary internal treatment. The urethra was daily irrigated with mild astringent solutions, and a glass of Vichy water was taken thrice daily. It was ascertained that his wife had, at the time and long before, been suffering from leucorrhœa, and that such was the cause of the urethritis which had attacked the husband. In a year after this the wife went on a visit to her relatives in the country. On her return in three months her husband became affected with urethritis, and again on a third similar occasion. This last did not so rapidly yield to treatment, though it was milder than the first two attacks. The wife had so far refused to submit to treatment; at length, consenting, she was relieved of her local affection, and her husband never again contracted urethritis even after an absence of several months. A point of much interest in the case is that after recovery from each of the attacks of urethritis the patient had no trouble until the first sexual approach several months after a forced separation from his wife. The case corroborates the assertion of Ricord in regard to what he terms "acclimation" of the genitals.

That some men are less susceptible to urethritis than others is a fact which careful observers have repeatedly verified. Of two men, of the same age and of equally sound body, indulging themselves sexually, within two or three hours, with the same woman, untouched meanwhile by others, one has escaped unharmed while the other has contracted urethritis. In some instances it happens that the first becomes diseased; in other cases it is the second that becomes affected.

Men contract urethritis from women suffering from malignant or from tubercular ulceration of the cervix uteri.

That women affected with ulcerated uterine epitheliomata, emitting acrid discharges, give urethritis to their husbands, is a fact which bears the attestation of physicians of extensive experience. The discharge from tubercular ulceration of the uterus is not only capable of causing urethritis, but of producing tuberculosis of the urethra. Some cases of tuberculosis of the male genital organs have been traced to this cause.

Masturbation as a cause of urethritis requires more than a passing notice. Those addicted to the vice of masturbation are, in consequence, attacked with urethritis with greater frequency than is generally supposed. This urethritis usually has the characters of chronicity from the outset, and the discharge is so slight that it at first escapes observation, or otherwise it is thought to be of little consequence by the patient, the sensitiveness of whose urethra has perhaps been blunted by long-continued abuse; hence the many cases of stricture, the origin of which is not satisfactorily traced, except by those physicians whose attention has been fixed upon such cases and who have been able to extract the truth from patients regarding early habits of masturbation. The common story of these patients is that they had noticed a constant urethral discharge which they had regarded as diurnal emissions of semen. In rare cases this urethritis becomes acute and even superacute.

Almost any sort of mechanical irritation of the urethra is likely to lead to phlegmasic action. Infant boys sometimes suffer much from urethritis by being fingered by vicious nurses desiring to gratify their own depraved instincts, or, as they often pretend, "to prevent the child from crying." Young boys are not infrequently attacked with urethritis during dental evolution, or during affections which lead to errors in nutrition, the consequent hyperlithuria being the chief factor in the causation of the urethritis.

Urethritis occurring in elderly men is often a source of much anxiety and suffering. A question often asked is, To what extent are elderly men liable to urethral phlegmasia, and does this differ from the urethritis of youth; if so, in what particulars? This question may thus be answered: While urethritis is generally simple, non-contagious, among elderly men, and is less frequent than among young and middle-aged men, it can not be regarded as an infrequent affection in advanced life. For instance, it occurs to a greater or less extent in a very considerable proportion of cases of enlargement of the prostate, and of gravel and stone in the bladder. It is not denied that elderly men are sometimes affected with contagious urethritis, for some among them are so unwise as to expose themselves to contagion, but happily they are comparatively few, and those who commit sexual excesses are not many. Urethritis is generally not so violent in elderly men as in youth or middle life. Only very exceptionally is it severe in the acute type, and it is very rarely superacute. Most frequently it is subacute and soon passes into the chronic state. It is characterized by less pain, less ardor, less dysuresis, and generally less purulent discharge than in youth, but it is more persistent and less amenable to treatment. In youth, in the great majority of cases, urethritis begins in the anterior extremity of the urethra, while in advanced life it very often begins at the posterior extremity or at once invades the whole canal.

DIAGNOSIS.—For diagnostic, prognostic, and therapeutic purposes it is essential to bear in mind the following points: Contagious non-infecting urethritis, "gonorrhœa," and simple non-contagious urethritis may be benign, subacute, acute, or superacute, and may be primitive, in cases where the urethra was never before diseased, or secondary in cases where the urethra had been the seat of phlegmasia at some more or less remote time. Primitive contagious urethritis is said to incubate from four to seven or even fourteen days, while primitive simple urethritis has a very short period of incubation, and sometimes declares itself a few hours after the action of the irritant which has been its cause. Secondary urethritis, whether contagious or non-contagious, has also a very short period of incubation. Urethritis ordinarily begins in the balanic region and gradually extends backward, sometimes even to the vesical orifice.

The adjective *benign*, applied by some authors to urethritis, is intended to signify a type characterized by mild symptoms, such as a little ardor in urination, an itching sensation in the fossa navicularis, and a slight mucous discharge, all of which disappear in a few days. Though benign urethritis may thus rapidly resolve, it is frequently in reality the first stage, the close of the period of incubation of the other types. That is to say, what for three or four days may appear to be a simple benign urethritis may become a subacute, an acute, or a superacute urethritis, or the discharge may become slightly purulent and persist as a chronic urethritis.

Subacute urethritis is characterized by a free muco-purulent discharge with but little redness of the urinary meatus and slight scalding sensation in urination. Its periods of increase, stasis, and decline are sometimes all ill defined or scarcely perceptible. Resolution occurs in from four to five weeks, or the discharge lessens, but persists and becomes chronic.

Acute urethritis, as before stated, begins as benign urethritis, which is its first stage, lasting three or four days. After this the discharge becomes purulent and soon thickens into a creamy state, yellowish at first and later greenish from an admixture of blood; the phlegmasic action daily augmenting until about the tenth day, when it reaches its maximum of intensity. During this time there is much scalding in urination, the lips of the meatus are red and pouting, and nocturnal erections of the penis are frequent and painful. This is the second or stage of increase, which has been termed the acute stage of acute urethritis, the adjective acute having already been used to qualify the type of a phlegmasia. The acute type, for instance, has its stages of incubation, of increase, of stasis, and of decline. Then comes the third stage or static period, during which the phlegmasic process neither increases nor diminishes. This period may be short, lasting one or two days, or may last from seven to ten days. It is followed by the fourth or stage of decline, which is the beginning of resolution. The discharge is then thin and pale, ceasing ordinarily between the fourth and sixth week. Among young and healthy subjects the first acute urethritis often resolves within three weeks. In some cases resolution is incomplete and the discharge persists indefinitely. The phlegmasia is then said to have passed into the chronic state.

Superacute urethritis is characterized by a superabundant flow of pus mixed with blood, all the other phenomena of acute urethritis being greatly intensified. There is often the complication of balano-posthitis with much œdema of the prepuce; the whole penis is swollen and the larger lymph vessels thereof are inflamed. Nocturnal erections of the penis are almost uncontrollable, extremely painful, and attended by what is commonly called chordee, which is a curvation of the distended penis toward the perinæum. This curvation is caused by a superabundant plastic exudation in the meshes of the submucous tissue and corpus spongiosum. The corpora cavernosa are gorged with blood, but, the corpus spongiosum being blocked by the exudate, complete erection of the penis is impossible. Retention of urine is of frequent occurrence in this type of urethritis. Resolution is generally incomplete, and the exudate becomes imperfectly organized, undergoes sclerosis, and stricture ensues.

Chronic urethritis is characterized by a slight mucopurulent discharge, often to the extent of a few drops only each day, but this discharge is persistent, and increases in quantity after a debauch or after sexual excess. Chronic urethritis is consequent upon any of the types to which reference has been made, or begins with the essential characters of chronic phlegmasia. Men suffering from chronic urethritis are much more liable to contract acute urethritis than those whose urethræ are sound.

The site of the urethritis due to chancre, mucous patches, or chancroids is the fossa navicularis, but in rare instances it has been discovered in the phallic and even in the perineal region of the urethra.

Contagious non-infecting urethritis begins in the fossa navicularis, and there remains stationary ordinarily for several days; then, if it do not speedily resolve, gradually extends itself as far as the sinus of the bulb, there to linger and become chronic, or on the third or even the fourth week may reach the urethro-vesical orifice, without, however, passing this limit—a fact which seems to justify the assertion that acute urethritis is a spreading angeioleucitis, terminating, as it does, abruptly at the neck of the bladder, beyond which no lymphatics have been discovered.

Simple non-contagious urethritis, like the contagious, often begins in the fossa navicularis and gradually extends backward, as was so well illustrated by Swediaur's experiment. He injected into his own urethra some diluted liquor ammoniæ, and soon thereafter experienced the most excruciating pain, followed by an acute urethritis which behaved very much like acute contagious urethritis and lasted six weeks, beginning in the fossa navicularis and ending at the urethro-vesical orifice.

As there are many exciting causes, so there are many varieties in the phenomena of urethritis. The phlegmasia may be mild and transitory, or it may be mild and persistent. It may be violent and transitory, or it may be violent and persistent.

It may begin and end in the balanic and phallic regions, or in the prostatic and perineal regions, or may invade the whole canal.

Its course may be benign or subacute for ten days or two weeks, and suddenly it may assume the characters of the acute or of the superacute type. As a general rule, this sudden change is provoked by some irregularity, such as a debauch, coition, etc., but sometimes the cause is not apparent.

The discharge throughout an attack of acute urethritis may be purulent and creamy, muco-purulent and glairy, thin and serous, or sanious.

An acute urethritis, at the expiration of four or five weeks, may seem to be cured, and in a week there may be a relapse, all the phlegmasic phenomena returning. It may then again yield to treatment, and in a week or ten days after the cessation of the discharge a second recrudescence may occur, and this second may be followed by a third relapse. Thus, the phlegmasia may continue several months. In a case observed long ago it lasted one year. The patient, a medical man, from that time suffered with cystitis, of which he was not well fifteen years afterward.

IX.

TREATMENT OF THE ACUTE TYPES OF URETHRITIS.

URETHRITIS, liable to divers accidents, complications, and consequences, may be regarded as a stricture *in posse*, the germ of a stricture—in other words, urethritis and the consequent stricture may be considered as a continuous process whose evolution begins at the inception of the phlegmasic action and ends with the confirmed stricture. Therefore the general indications of treatment of urethritis are—1, to remedy the phlegmasia; 2, to guard against accidents and complications; 3, to prevent the formation of stricture; and 4, to minister promptly to other consequences of this phlegmasia. The special indications vary with the types, stages, and complications of the affection, with the peculiarities and general condition of the individual, and with his hygienic environment.

ABORTIVE TREATMENT.—The treatment of acute urethritis was for a long time based upon erroneous notions of its nature, and directed to the substitution, as it was believed, of a simple, inoffensive, for a specific phlegmasia. This treatment, suggested in 1780 by Simmons, and afterward largely employed by Ricord, Diday, and others, consisted of urethral injections of nitrate-of-silver solution (ten, fifteen, or twenty grains to the ounce), and was named the abortive, to distinguish it from the methodical treatment.

This supposed quick way was as delusive as it was alluring, alike to patients and to physicians, for it seldom cut short the attack of urethritis, and besides the great distress it caused, was often productive of grave effects upon the urethra and adjacent parts, the first effect being a super-acute urethritis, then peri-urethritis, lymphangeitis, sometimes prostatitis, trachelocystitis, gonecystitis, orchitis, etc. Inasmuch as this too heroic treatment is still, though very rarely, recommended, it was thought necessary to give this note of warning to younger members of the profession against the employment of means which not only fail to remedy but serve to aggravate the affection.

Two other modes of abortive treatment were afterward employed: 1. The administration of balsamics alone. 2. The balsamics and urethral injections combined. They also have proved worse than useless. The balsamics alone were much used by Cullerier, who gave them in very large doses. He prescribed from twenty to fifty grammes of powdered cubebs each day, alternating with copaiba balsam, of which he gave from fifteen to twenty grammes a day in divided doses. Such doses may for a few days be tolerated by some stomachs, but how fatal they must prove to the faithful kidneys which distill the active principles of these drugs that, through the urine, they may act upon the diseased urethra!

The association of astringent injections with balsamics was extolled by Ricord when nitrate of silver failed. The substances used for these injections were sulphate of zinc and acetate of lead, or the two together, three and five grains to the ounce, repeated three times daily.

Urethral injections with copaiba-balsam emulsion have also been used, but soon abandoned on account of the great ensuing irritation. Then were vaunted many "infallible remedies," used by mouth or applied by injection or through soluble bougies, all of which have done infinite mischief. These panaceas were generally prescribed without regard to the particular stage of the phlegmasia.

A complete list of the drugs given for, and the modes of treatment of, urethritis that have been used and failed or caused serious harm would more than fill a large and thick quarto volume printed in small type.

METHODICAL TREATMENT.—To treat urethritis rationally and methodically, it is necessary first to ascertain the nature, cause, type, and precise stage of the phlegmasic attack, and the general condition of the sufferer.

Hygienic Precautions.—From the beginning to the end of this treatment the most rigid hygienic precautions should be taken, if only as prophylactic of accidents and consequences. Among the enjoinments are continency and avoidance of all manner of sexual excitation during the treatment and for a month after the cure, and abstinence from foodstuffs that may be trying to the digestive process or that are likely to act injuriously through the urine, which is one of the most important factors both for ill and for good in urethritis. For ill, when it is excessively acid and charged with acid phosphates or with uric acid, or when it is excessively alkaline and loaded with triple phosphates. For good, when it can be kept bland and when it can be made the carrier of medicinal agents. Therefore the physician should keep a close watch over the urine throughout the treatment of urethritis. The diet should not otherwise be restricted, except in quantity, which may be a little less than in health, but not so decreased as to reduce the vital powers. An already feeble patient is benefited by a generous diet, with even a moderate allowance of wine, and is thus placed in a condition to recover from his urethritis much sooner than he would under insufficient alimentation.

The most scrupulous cleanliness should be observed. The glans penis should be bathed twice or thrice daily in a solution of mercuric chloride (one to ten thousand), and the patient cautioned against carrying his hand to the face or near the eye after touching the genitals, and to burn all cloths that may be impregnated with pus. The reason for these precautions should be fully explained to him, for they are among the most essential of the hygienic observances, without which virulent ophthalmía is almost certain to ensue.

The bed on which he sleeps should not be too soft, the covering should be as light as the state of the weather permits, and the room as little heated as possible. This, in a measure, tends to prevent erections.

Much walking or any prolonged exertion should be avoided, as either is conducive to complications and consequences, such as œdema of the prepuce, phimosis, lymphangeitis, orchitis, etc.

General Treatment.—The first stage of urethritis or, as it is called, benign urethritis, which is the period of incubation of acute urethritis, should be treated with a view of favoring its early deliquescence. When a patient presents himself three or four days after a sexual debauch, complaining of a little ardor in urination, and has a slight clear mucous urethral discharge and some congestion of the mucous membrane at and within the meatus, the physician—after inquiring into the circumstances of the debauch, particularly if the culprits had both indulged freely in beer, wine, or spirit, and what was the degree of sexual erethism in both—is ready to pass judgment upon the question as to whether this is or is not the beginning of an acute urethritis. If he has a doubt, he should give the patient the benefit of that doubt by treating the case as if it were going to be acute urethritis. The treatment should first be directed toward rendering the urine as inoffensive as possible. If the urine contains a great excess of uric acid, four or five doses of ten grains each of sodium salicylate, largely diluted, should be given during the first day only. Afterward twenty grains of sodium bicarbonate, also largely diluted, should be given four times daily, adding the juice of half a fresh lemon to each dose, thus making a citrate of sodium, which is better tolerated by the stomach than the salicylate. The depletion produced by a brisk saline cathartic (an ounce of sulphate of sodium) is of much service in this stage of the phlegmasia. Rest at this period is of much consequence, and may in the end be a great saving of time.

The local treatment of the first stage of urethritis consists of two daily irrigations of the phallic region of the canal with a solution of mercuric chloride (one to ten thousand, or even one to twenty thousand). The quantity for each irrigation should not be less than a pint of water at a temperature of 102° to 105° F. The greatest care should be taken against bruising or in any way irritating the urethra during these irrigations. A smooth, hollow bougie of gum or glass, not over four inches long, acorn-shaped at its vesical extremity, not larger than No. 10 English, with three or four perforations at the base of the acorn, may be used for the purpose. The bougie, fastened to the long India-rubber tube of a fountain syringe, is then gently passed into the phallic region of the urethra for about two inches and a half and the irrigation begun, the retrograde current washing all that part of the urethra anterior to the acorn, and running out into a vessel placed between the thighs of the patient, who should then be sitting upon the edge of his bed or chair. If the irrigations are well tolerated by the urethra, and if the urethral congestion is decreased in the course of two days, the treatment should be continued several more days to insure deliquescence of the phlegmasia. But if, on the contrary, the discharge increases and becomes opaque, showing the advent of the second stage, the irrigations should at once be stopped, as otherwise they would be likely to cause superacute urethritis and its consequences.

If, when a patient first applies for treatment, the discharge, instead of being clear mucus, is already opaque, it indicates the presence of pus and the beginning of the second stage. In such a case the local treatment by irrigations should not be employed. The first part of the treatment, *i. e.*, the citrate of sodium, etc., should constitute the principal remedial means.

Patients very rarely apply for treatment until the second stage of urethritis is fully established. It is then that meddlesome treatment and polypharmacy are so often carried to the greatest excess, partly through the solicitation of the anxious patient, partly owing to misinterpretation of the phenomena of urethritis, and to the vain search for a specific, and it is then that the misguided employ blindly those heroic means which so surely lead to serious consequences.

Subacute urethritis, whose characters in its second stage are generally a free purulent discharge with little exfoliation of epithelium, comparatively little pain, very little scalding in urination, and no nocturnal erections, notwithstanding its mildness, is persistent and requires careful management lest it become acute or superacute. In the second stage of subacute urethritis the same hygienic precautions should be taken as in the other types, and the same diluent beverages as those used in the first stage, only it is wise to vary the drink every few days, substituting uva-ursi, buchu, or dog-grass tea for the citrate of sodium, and finally returning to the sodium citrate. In the subacute, like the other types, balsamics should not be used for several weeks, or not until the stage of decline, and should not be given in as large doses ; nor should irrigations be employed until very near the close of the period of decline, when the discharge has decreased to a few drops each day.

The second or stage of increase, of greatest activity, of the acute type of urethritis, during which it is steadily extending backward, attended as it is with much pain in urination, owing to extensive exfoliation of the urethral epithelium, and with painful nocturnal erections of the penis, demands an antiphlogistic medication. During this stage balsamics and injections are worse than useless, and provocative of complications and consequences which not only retard the cure but are in themselves of grave import. They should therefore under no circumstances be administered during that period. The amount of food should for a few days be lessened; a saline laxative, two drachms of sulphate of sodium in six ounces of hot water, should be given every morning; thirty grains of citrate of sodium four times daily for three or four days; a full bath of half an hour at a temperature of 102° during these four days, after which a nightly hot hip bath of five minutes is substituted; and absolute rest. Four or five times during the day the penis should be dipped, for cleansing and for urination, into a small vessel of warm mercuric chloride solution (one to five thousand). To combat the nocturnal erections of the penis, ten grains of camphor and one grain of hyoscyamus extract may be given at bed-time and once repeated during the night if necessary. For a fidgety algophobic patient a dose of thirty grains of sodium bromide largely diluted may be given instead of the camphor and hyoscyamus.

In this second stage superacute urethritis is similarly treated. To relieve the excessive pain during erection and chordee, the penis should be immersed in a vessel of iced water, wherein the patient may then urinate much to his relief. A full dose of opium during the day and a rectal suppository of a grain of opium and half a grain of belladonna-extract at night may be necessary to relieve pain and induce sleep. The application of ten or twelve leeches to the perinæum often has the effect of relieving extreme pain and of shortening the period of increase. This of course is advisable only in the case of strong and robust subjects.

During the third stage or static period, this active antiphlogistic treatment is discontinued. The five-minute hot hip baths are, however, continued. The quantity of diluents is diminished or their constituents changed, and the case is otherwise treated in accordance with such new indications as may arise. The static period is generally of short duration, and if there be no complications or consequences, such as will be described later, the fourth stage soon begins.

The fourth stage or period of decline, is ordinarily the beginning of resolution, which may be rapid and complete in two or three weeks, or slow and last four or five weeks, or incomplete and indefinite and merge into chronic urethritis. During this period of decline the phlegmasic phenomena are absent, and there is only the purulent discharge, which is less in quantity and very perceptibly altered in quality. It is no longer creamy and contains more mucus and less epithelium. There are no painful erections of the penis, and the urine has ceased to cause scalding pain. It is at this time that the diluents should be suspended and that the balsamics may safely be administered, but not in the large doses so commonly given, such as three drachms daily of copaiba balsam or one ounce of cubeb powder. Both of these drugs, thus given, within three or four days become so nauseating that the most willing patients reject them. In moderate doses they are longer tolerated, but finally disturb the digestive process and have to be abandoned. About twenty-five years ago sandal-wood oil was suggested by Henderson as preferable to copaiba. Since then experience has demonstrated this superiority, and the sandal oil is now much more extensively used than copaiba, whose properties it possesses without its disadvantages. But even this oil should not be given in large doses. Two capsules, containing each ten minims of sandal-wood oil, may be taken four times daily for a week, then three times daily for another week, and during the third week the dose should be decreased until the patient shall have taken only one capsule, when the drug is discontinued. There are patients that can not bear even this comparatively mild treatment. Their troubles last longer, but after all get well without it.

Not until the stage of decline is far advanced should urethral injections be used, and then only if after the use of the balsamics there is still a slight discharge. Before this time even mild injections are liable to cause lymphangeitis or peri-urethritis. Strong astringents should be particularly avoided. The ignorant believe that to cure a urethritis the urethral mucous membrane must be practically tanned. Injections, to be effective, should be used in large quantity, but in weak, unirritating solution, and only once daily during this stage of urethritis. The small urethral syringe containing an ounce of fluid, used three or four times daily, does more harm than good, for each introduction of its nozzle is a hurt to the urethra. Among the most efficient agents for urethral irrigation in these cases are the corrosive chloride of mercury (1 to 10,000) and the sulphate and chloride of zinc. Of a solution of sulphate of zinc, half a grain to a grain to the ounce of water, a pint is to be used at night or in the morning by means of the simple apparatus and fountain syringe already described, except that the hollow bougie should be about nine inches long in order that it may be carried as far as the sinus of the urethral bulb or farther if necessary, so that the whole urethra may be washed. The chloride of zinc, the other precious agent for urethral irrigation, should be used in even weaker solution than the sulphate—from a quarter to half a grain to the ounce. In some cases a solution of boric acid, two grains to the ounce, suffices to cleanse the urethra and arrest the discharge.

In the majority of cases this simple treatment, which can be applied by the patient himself, answers well, and the urethritis is cured in five or six weeks. Other cases, whether complicated or uncomplicated, are refractory to treatment and linger many months or years. These are principally cases of secondary urethritis, the patients having suffered from the phlegmasia once or twice before, or possibly being affected with granular urethritis or already with stricture, or perchance with urethral mucous patches or tuberculosis. The special treatment required by these cases will appear in its appropriate place.

Among the medicinal agents that have been used in Bellevue Hospital for injections in urethritis may be mentioned solutions of the violet methylaniline, of permanganate of potassium, of permanganate of zinc, of phenol, of hydrastis, and many others, mostly with unsatisfactory results.

As a general rule, when uncomplicated urethritis is well cured there are no sequelæ. Some patients, however, suffer for many months after the cure from oversensitiveness of the urethra, unduly frequent urination, or a superabundant mucous secretion, due generally to hyperlithuria, and demanding a treatment appropriate to that condition. In other cases a very slight opalescent urethral discharge persists. In these cases the careful introduction of a bulbous bougie reveals one, two, or three tender spots along the urethra. These tender spots are places where there has been a greater degree of epithelial exfoliation than elsewhere in the canal, and the denuded spots, though afterward covered with granulation tissue, are oversensitive even to the passage of urine, and it is from them that issues the slight discharge. The treatment required is an occasional urethral irrigation and the introduction, twice a week for two or three months, of a steel sound to dilate the canal moderately, to restore its suppleness, to destroy the granulation tissue, to relieve the sensitiveness, and to prevent the formation of stricture.

Conclusions.—The study of the nature of urethritis and of the many modes of treatment proposed for its cure has led to the following conclusions:

1. There is no specific for urethritis, notwithstanding the popular belief in its existence.

2. Urethritis can not rationally be dealt with as a single phlegmasic entity, no matter what may be its cause.

3. The nature, course, and pathic properties of the different stages of the acute types of urethritis indicate that an exclusive method of treatment can not be carried out in all cases with a reasonable prospect of success.

4. The treatment that is suited to one type or stage of urethritis is often hurtful in another type or stage of the affection.

5. The same therapeutic agent, applicable to a particular type or stage of the phlegmasia, is not suitable to all individuals.

6. Balsamics are contra-indicated during the first three stages of urethritis, and should not be administered until the fourth or stage of decline is fully established.

7. Urethral injections are contra-indicated during the second and third stages of urethritis, but may be used in the first stage and toward the close of the fourth stage.

8. Injections of strong solutions of nitrate of silver, or of strong solutions of any kind, are contra-indicated in all the stages of urethritis.

9. Urethritis is ordinarily too much and too vigorously treated. The more heroic and meddlesome the treatment, the greater the liability to accidents and complications, and the longer the duration of the phlegmasia.

10. Confirmed acute contagious urethritis, under the most favorable circumstances and the most judicious treatment, rarely gets well in less than four weeks, except of course in the first attack in young and otherwise healthy men who are not overtreated. In the last-named cases it sometimes gets well in ten days or two weeks without medicinal treatment.

11. Proper hygienic management is all-important in the treatment of urethritis; unless it is rigorously carried out, the medicinal and local treatments inevitably fail.

X.

Accidents, Complications, and Consequences of the Acute Types of Urethritis.

When exempt from accidents, complications, and consequences, urethritis resolves in four or five weeks, or, if primitive and in a young healthy subject, may be cured in eight or ten days. It is principally in this second class of cases that the rapid cures are so frequently reported, while the accidents, complications, and consequences are too often ranked by themselves as if they had no connection with urethral phlegmasia. It is therefore necessary, in the management of urethritis, to keep in mind the liability of the occurrence of the accidents which may arise from the imprudence, carelessness, or neglect of the patient; of the complications which aggravate the urethral phlegmasia; and of the consequences of unwise, untimely, or rash treatment. Not many years ago was still in vogue the routine treatment of "gonorrhœa," consisting in the administration of large doses of copaiba or cubebs, and in the use of strongly astringent urethral injections, without regard to the type or stage of the phlegmasia. The frequency of accidents and of more or less grave sequelæ was then great as compared to what it is at present. The rational treatment, based as it is upon a sounder pathology and more accurate diagnosis, seems now to be so firmly established that these accidents and sequelæ occur with markedly less frequency than in former times, and are much better managed.

The accidents of acute urethritis are urethral hæmorrhage and conjunctivitis. The complications to which acute urethritis is liable are balanitis, posthitis, and balanoposthitis, the last causing or aggravating phimosis, and the forcible retraction of the narrowed and swollen prepuce producing paraphimosis. The consequences of acute urethritis are lymphangeiitis, inguinal adenitis, peri-urethritis, cryptitis, bulbo-urethral adenitis, prostatitis, orchitis, gonecystitis, trachelocystitis, pyelitis, nephritis, septicæmia, pyosapræmia, rheumatism, chronic urethritis, and urethral stenosis.

ACCIDENTS OF URETHRITIS.—*Urethral hæmorrhage* during acute urethritis is ordinarily due to frequent and prolonged erections of the penis, to masturbation, or to coitus, and is not an uncommon accident. It is rarely abundant, and ceases spontaneously in the majority of cases. Preventive and afterward repressive means should be promptly employed, for the reason that hæmorrhage indicates here a solution of continuity of the mucous membrane, and therefore liability to a rapid stenotic process. Profuse hæmorrhage is rare and generally due to "breaking the chordee" in superacute urethritis. It usually ceases spontaneously in the course of thirty-six hours, but sometimes continues several days, much to the detriment of the sufferer. Active measures should therefore be taken to suppress the flow of blood. If cold fails when applied externally or by way of intra-urethral irrigations, it is wise, without further delay, to introduce a urethroscope as far as the seat of hæmorrhage, to wash away the blood with iced water, and to touch the bleeding spot with a camel's-hair brush previously dipped in persulphate of iron solution, and then to irrigate once more in order to be sure that the hæmorrhage is checked. The patient should be kept quiet in bed, cold external applications continued several hours, and other suitable means taken to prevent erections, but the parts should not be meddled with any further, for the more handling, the greater the liability to recurrence of the hæmorrhage. Internal pressure by the introduction and maintenance in position of a large catheter has been recommended in these cases, but this should be avoided except in the most extreme circumstances. The presence of such a foreign body becomes almost intolerable, and in the course of three or four days is liable to cause ulceration of the mucous membrane, and even perforation of the urethra and urinary fistula.

Virulent conjunctivitis arises from the accidental contact of pus from virulent urethritis with the conjunctiva. The pus may be conveyed to the eye by a soiled hand or through some other medium, such as a towel or cloth polluted with urethral pus. The right eye is oftener affected than the left, and both eyes are very rarely involved. This phlegmasia, commonly called "gonorrhœal ophthalmia," is, fortunately, an extremely rare accident of urethritis, for it is ordinarily superacute. Though it may resolve in a few days under suitable treatment, leaving but slight traces of its occurrence, its sequelæ are frequently refractory to treatment, and sometimes fatal to vision. Its progress is occasionally so rapid that the eye perishes in a few hours after the first symptoms. It is characterized at its outset by some itching of the edges of the lids, by a sensation as if a small foreign body had lodged beneath the eyelid, and by great increase of lacrymation. Then follow much turgescence of the conjunctival capillaries, chemosis, intense pain in and around the eye, annoying photophobia, and a profuse flow of pus. The chemosis sometimes increases so rapidly as to strangulate and destroy the cornea before medical aid can be obtained.

The main features of the treatment employed by experienced ophthalmic surgeons is here given to guide the general physician in whose practice cases of virulent conjunctivitis occur, for the salvation of these inflamed eyes depends upon the promptness and efficiency of the treatment which should be forthwith begun, to be vigorously continued until the arrival of an expert ophthalmologist, with whom the responsibility of the further management of the case is shared. But, inasmuch as an ophthalmologist may not be accessible for several hours, or even for a day, as in small towns, the general physician should render himself competent to manage cases of virulent conjunctivitis to the end. For his own protection he should, at his first visit, make a note of the exact condition of the eye, and have some person to witness this examination of the eye and of the writing of the memorandum, which he should sign and the witness should countersign.

The treatment of this violent phlegmasia should be most prompt and energetic, the prime indication being to check the rapid phlegmasic process and thwart its destructive tendency. In the early stage, and then only, free local depletion should be effected through leeches applied to the temple close to the outer canthus of the eye. The instillation of atropine solution should at once be begun, to be continued to the end of the phlegmasic process. Copious catharsis should be induced. The patient should be placed in a dark room and his sound eye properly protected, but the inflamed eye should not be covered. A nitrate-of-silver solution, sixty grains to the ounce, should be applied once each day to the whole conjunctival surface with a camel's-hair brush, and immediately washed away. When chemosis appears, free cuts should be made through the conjunctiva radiating from the cornea's edge. But what is most efficient and most to be depended upon to relieve the chemotic pressure upon the eye is free section of the external canthus, including the dense aponeurotic layer, and this simple operation can not too soon be employed in cases of extreme chemosis. Almost incessant ablutions of the eye during the first forty-eight hours should be made with cold, mildly astringent antiseptic solutions, and this eye kept under the watchful care of a trustworthy and faithful nurse, who shall obey strictly the physician's directions. After forty-eight hours, or after the danger of strangulation of the cornea is passed, the ablutions need not be so frequent and the nitrate-of-silver solution may be weaker, but still used once daily until the conjunctival membrane appears normal. If the whole cornea have already sloughed, the eyeball should be extirpated as soon as expedient after the termination of the phlegmasic process.

COMPLICATIONS OF URETHRITIS.—*Balanitis*—phlegmasia of the glans penis, involving the mucous membrane, the spongy substance, or both—is characterized, in the first case, by an itchy and burning sensation, more or less intense redness, swelling, and at length a purulent discharge. It may be of the same nature as, or may have appeared before, the urethritis, by which it is intensified, particularly when caused by the accumulation of smegma. In superacute urethritis there sometimes occurs an abundant plastic exudation in the substance of the glans penis, which swells and becomes very tense. Resolution is slow or is not accomplished, and the imperfectly organized exudate undergoes sclerous degeneration, causing irregular shriveling of the glans. Subacute balanitis, with plastic exudation and induration of the glans, is often the outcome of violent, careless, and unduly frequent catheterism. The induration thus caused is most apparent around the urinary meatus, and is in some cases so strongly marked as to be mistaken, at first sight, for malignant disease.

Posthitis—phlegmasia of the foreskin of the penis, affecting its mucous layer, its cutaneous layer, or both of these layers—sometimes exists independently of balanitis, but, as a general rule, is associated with balanitis and is designated as balano-posthitis. Posthitis occurs frequently in young subjects affected with vesical stone, causing frequent and painful urination and subacute urethritis; this frequent escape of urine, and the traction upon the prepuce made by the sufferers in endeavoring to obtain relief, being the exciting cause of the posthitis. The foreskin is elongated, sodden, swollen, red, and painful, and its mucous membrane emits pus and sometimes blood. This sodden condition of a long prepuce in the adult occurs in cases of urethral stenosis and obstruction to urination from other causes leading to unduly frequent urination or to constant dribbling of urine.

Infibulation of the prepuce—a device of very ancient date, to insure continency among the young until the age of twenty-five, described by Celsus, practiced extensively in the middle ages, condemned by Dionis and others during the seventeenth century, seriously recommended within the last fifteen years as a cure for "epilepsy and seminal loss"—is still occasionally, but secretly, employed. It is hurtful not only on account of its favoring the accumulation of filth, but of the irritation excited by the buckle, which is liable to induce posthitis with so much induration of the foreskin as to lead to the suspicion of malignant disease. Dupuytren relates such a case which at first he believed to be cancer of the prepuce. The jealous mistress of the patient had succeeded in inserting an ingeniously contrived gold ring through the end of the foreskin and had locked it. In the course of time the extremity of the penis was so much enlarged, indurated, and painful, that the ring was removed; this afforded relief from the pain, but the swelling and induration were slow in yielding to treatment. The parts finally regained in a measure their normal state.

Balano-posthitis is generally due to the accumulation of smegma beneath a long prepuce, but at times it begins with the attack of urethritis, and is even superacute and associated with lymphangeiitis. The mucous membranes of the glans and prepuce are tumid, of a vivid red, very sensitive, and emit a considerable quantity of pus. In extreme cases, complicated with phimosis, these mucous membranes ulcerate in patches, so that when cicatrization is accomplished the two surfaces adhere permanently unless precautions are taken against the occurrence of such adhesion.

The treatment of balanitis and balano-posthitis, in cases where only the mucous membranes are involved, and the prepuce is short or easily retracted, consists in thoroughly cleansing the glans and prepuce with antiseptic solutions three or four times daily, and after each washing to cover the affected parts with a thin layer of a powder composed of equal parts of oxide of zinc and boric acid, or else aristol, or europhen which is said to be an iodide of isobutylorthocresol and which does not possess the objectionable odor of iodoform. Ointments are not tolerated in the majority of cases.

Phimosis.—Balano-posthitis complicated with phimosis not being amenable to treatment by powders, the preputial cavity should be irrigated with antiseptic fluids two or three times daily until the subsidence of the phlegmasic process. If the prepuce be only long enough to cover the glans penis, divulsion of the preputial orifice may be employed to relieve the constriction; but if this orifice be extremely narrow or its edges much indurated, posthetomy will be the more efficient procedure. This operation consists in making a longitudinal incision through the skin and mucous membrane of the prepuce on its dorsal aspect, so that the glans can be easily exposed. The edges of the skin and mucous membrane should then be stitched together, so as to obtain a transverse scar from the longitudinal incision, and thus increase the size of the preputial opening.

When the prepuce is long and so narrow as to render its retraction difficult or impracticable, posthectomy should be performed, but not until the subsidence of the phlegmasic process, unless the integrity of the glans be imperiled by the existence of chancroids. This minor operation, performed for many thousand years largely as a religious rite, consists in cutting away the superabundant foreskin and enough of its mucous membrane to permit the glans penis to be easily uncovered. As a religious rite the greater part, if not the whole prepuce, is removed. For the purposes of the surgeon it is rarely necessary to make a complete posthectomy. The operation is the same in principle as it has ever been, but its details have undergone many hundreds of modifications. The essential steps of posthectomy are—1, to pull gently forward the prepuce; 2, to apply a suitable clamp to retain it in position and to protect from injury the extremity of the glans penis; 3, to quickly cut away all that part of the prepuce isolated by the clamp; 4, to remove the clamp and slit the mucous membrane longitudinally not more than half an inch; 5, to trim with scissors the angles of the mucous membrane; 6, to take proper means to arrest any oozing of blood or, if necessary, to tie bleeding vessels; 7, to stitch the mucous membrane to the skin with very fine silk or with horse-hair; and 8, to apply a light dressing to the parts. In very young subjects no stitching is necessary. Ordinarily the wound heals primarily.

Paraphimosis, an accident of phimosis, occurs from the forcible retraction of a narrow prepuce for the purpose of cleansing the glans, or during coition or masturbation. It is then very difficult or impossible for the patient to bring foward the retracted prepuce, owing to swelling of the glans penis. When paraphimosis has existed several days it is not possible sometimes, even after section of the constricting ring, to replace the foreskin. Ordinarily it is rather an inconvenient and unsightly deformity than a dangerous condition, for the glans penis is very rarely damaged by an irreducible paraphimosis. A portion of the dense ring into which the retracted prepuce is converted finally sloughs and the strangulation ceases, but the adhesions which take place forbid the ultimate reduction of the prepuce.

The reduction of the retracted prepuce in paraphimosis can generally be effected by compressing the glans penis and pushing it backward while the prepuce is, as it were, unrolled upon the glans, using for this purpose the thumb and index and middle fingers of each hand. This process is applicable only before the glans penis has become very tumid. When the tumefaction of the glans is such as to forbid reduction by this method, a simple and quick process is to apply elastic compression by means of a bandage, one inch wide, of thin India-rubber, such as dental surgeons use under the name of rubber dam. Compression so made expels the blood from the glans and sufficiently decreases its size to permit of reduction of the retracted prepuce. The last turns of the bandage should be applied to the œdematous prepuce to expel the serum from the meshes of its connective tissue. The bandage is not removed from the glans penis until the reduction is nearly complete. It has been proposed to relieve paraphimosis by placing the patient on his back, grasping the penis with one hand, and striving thus to lift him. This is said to have been practiced on children as well as on adults. The violence of this remedy is such as to make it worse than the discomfort which it is designed to relieve, for the traction incident to the effort of raising the whole body by the penis is so great as to seriously injure the urethra, and possibly also the cavernous bodies.

CONSEQUENCES OF URETHRITIS.—*Lymphangeiitis* of the larger subcutaneous lymphatic vessels of the penis occurs in consequence of slight injuries, of friction by the clothing during exercise, or of the untimely use of urethral injections. The phlegmasia may be subacute, acute, or superacute.

Subacute lymphangeiitis is characterized by its indolence, by the slight engorgement of the subcutaneous lymphatics, and by a little œdema of the neighboring connective tissue. It is a frequent consequence of acute urethritis and may appear during the first ten days or not until the decline of the phlegmasia. It rarely suppurates and resolves under rest and simple lotions in the course of four weeks.

Acute lymphangeiitis is characterized by longitudinal reddish tracts in the course of the lymphatics, which are tense, nodulated, and tender to the touch, from the preputial frænum to the inferior inguinal glands where they terminate. The prepuce is much swollen from serous exudation, and sometimes the whole phallic integument is in the same tumid condition. This type of lymphangeiitis very rarely suppurates, and resolves in the course of three or four weeks under absolute rest in recumbency and soothing lotions.

Superacute lymphangeiitis is characterized by a diffuse erysipelatous redness and swelling of the integument of the whole penis. Although it most frequently resolves under the same management as the acute type, it is sometimes followed by abscesses in the course of the lymphatics, and in very rare instances by diffuse suppuration, requiring free and early incision. In still more rare instances the phlegmasia is propagated to the cavernous bodies of the penis (phallitis), and leaves a certain amount of induration which deforms the penis during erection. This plastic exudation in the cavernous bodies sometimes undergoes calcareous infiltration, a condition often miscalled bony transformation of the penis.

Inguinal adenitis often follows lymphangeiitis of the penis consequent upon urethritis, but it also occurs without there being any lymphangeiitis, and may appear as a consequence of any of the forms of virulent urethritis or of simple non-contagious urethritis. One or more than one gland may be inflamed. The phlegmasia may resolve after a few days of rest, may be indolent, or suppuration may ensue. This form of adenitis is one of the varieties of non-syphilitic buboes; there being two varieties, one of which resulting from chancroids of the penis or urethra, the other from non-infecting urethritis. These buboes are ordinarily on a level with or a little below Poupart's ligament, and may be unilateral or bilateral. In the event of suppuration, the diseased glands should be freely incised, and in some cases excised.

Peri-urethritis arises as a consequence of acute, but more frequently of superacute, urethritis, the phlegmasic process extending itself to the submucous connective tissue or even to the spongy substance, and occupying a part or the whole circumference of the urethral canal. It occurs in the perineal, in the scrotal, or in the phallic region of the urethra, most frequently in the last-named region. It is often provoked by untimely urethral injections, by the so-called abortive treatment of benign urethritis with strong solutions of nitrate of silver, by violence to the inflamed urethra such as may occur from coition or from masturbation, or by any ingested substance which may render the urine acrid. It is characterized by a more or less abundant plastic exudation in the submucous connective tissue, or both this and the spongy substance. The exudation may occupy the whole extent of the inflamed part of the urethra or may be confined to one or several isolated points, causing much pain during erection and, to a greater or less extent, curvation of the penis (chordee). When the exudate retains its semi-fluidity it may soon be absorbed, or may end in suppuration and peri-urethral abscess. The abscess opens oftener in the urethra than externally. In the latter case the urethra may be perforated and a urinary fistula thus established. When the exudate is partly organized, sclerous degeneration begins and urethral stenosis is the sequel. This sclerous degeneration may be so rapid that in a few months the lumen of the urethra is reduced to the point of admitting only a capillary bougie, or it may be so slow that five, ten, twenty, or even thirty years may elapse before the caliber of the urethra is sufficiently reduced to attract the attention of the sufferer.

In the treatment of peri-urethritis the first indication is the discontinuance of the injections which may have provoked the phlegmasia. If balsamics had already been administered, they too should be discontinued. The patient should be confined to bed for five or six days, and means taken to abate the frequent and painful erections of the penis which so much aggravate the phlegmasic process. An evaporating lotion, or, better, dry cold, by mediate irrigation, as suggested by Petitgand, applied through India-rubber tubing of small size and thin walls, coiled around the penis so that a continuous flow of water at any desirable temperature may be used without wetting the bed or otherwise inconveniencing the patient, has the double effect of preventing erections and of acting as a local antiphlogistic. The urine should be rendered bland by the administration of diluent drinks, and five grains of gum camphor, one grain of hyoscyamus extract, and five grains of taraxacum extract, made into a bolus, should be taken at bed-time and, if necessary, once again during the night.

When these means fail to induce resolution, and suppuration ensues, the peri-urethral abscess opening in the urethral canal, it is necessary to take measures to prevent the entrance of urine, rare as this occurrence may be, into the abscess cavity for two or three days, or until the formation of granulation tissue. This is effected by the passage of a small, soft catheter whenever urination becomes necessary. If the abscess points externally, it may be incised, or, if small, the few drops of pus it contains may be removed by aspiration, as advised by Christian Smith. For this purpose the ordinary syringe employed for hypodermic injections may be used. This simple process, perhaps repeated two or three times, tends to prevent urinary fistula. Should it, however, fail, a sufficiently free external incision would be indicated.

When resolution is slow or when the exudate, instead of leading to suppuration, becomes more consistent, with a tendency to undergo organization, the oleate of mercury, applied daily along the under surface of the penis or the perinæum, according to the site of the peri-urethritis, is of much advantage. In obstinate cases the oleate of mercury may be replaced by vesicating collodium once every week until this vesication has been used three or four times. Internally the bromides of sodium, ammonium, and potassium, two grains each, should be given in a wineglass of water four times a day for a week or ten days.

Resolution failing, the peri-urethritis becoming chronic, or sclerotic degeneration beginning, which is the same as saying that a stenotic process is established, the most efficient method of treatment, designed to prevent the formation of a narrow stricture, is free dilatation of the urethra once a week continued several months.

Urethral cryptitis—phlegmasia of the mucous follicles of the urethra—a common consequence of acute urethritis, is often very persistent and sometimes constitutes the main cause of chronic urethral discharges. It occurs most frequently in the balanic region, but may affect one or many follicles in any part of the urethral canal. It happens occasionally in acute urethral phlegmasia that the mouth of a follicle becomes occluded by swelling of the mucous membrane. Purulent accumulation ensues, distends the follicle, and forms a small, hard, globular, or ovoid abscess, containing only four or five drops of pus, which is finally discharged into the urethra, or externally through a very narrow orifice. This orifice does not always close, and there remains a fistulous tract through which some urine escapes. To prevent the formation of a fistula, an attempt should be made to open the mouth of the inflamed follicle with a slender probe, such as the smallest used in stenosis of the lacrymal ducts, so that the pus may escape in the urethra. This failing, aspiration is made as in peri-urethral abscess, or even external incision. The treatment of chronic cryptitis will be considered under the head of chronic urethritis.

Bulbo-urethral adenitis is a rare consequence of acute urethritis. This phlegmasia having already been described, it is now only necessary to thus briefly notice it as a consequence of acute urethritis.

Prostatitis, having also been described, requires no further examination.

Orchitis is used as a generic term to signify a phlegmasia affecting any or all of the divisions of the testicle. Epididymitis is the term commonly used for phlegmasia of the summit of the testicle, and didymitis for phlegmasia of the body of the testicle, the latter occurring rarely. Of 222 cases of epididymitis consequent upon urethritis observed by Fournier, 164 were from acute urethritis and 58 from chronic urethritis. Of the 164 cases from acute urethritis, 6 occurred during the first ten days of the urethritis, 15 on the eleventh day, 34 during the third week, 30 during the fourth week, 29 during the fifth week, 19 during the sixth week, 9 during the seventh week, and 21 during the eighth week. Of the 58 cases from chronic urethritis, 22 occurred during the third month, 1 during the seventh year, and the remainder scattered between the fifth month and the fourth year.

Epididymitis is a frequent consequence of urethritis. It occurs in about thirty per cent. of all cases of acute urethritis, and generally appears on or about the third week from the beginning of the urethritis—*i. e.*, during its period of decline, or after it has reached the prostatic region. However, this extension of the phlegmasia to the prostatic region sometimes occurs in a few days after the beginning of the urethritis, particularly if the urethritis begins in the prostatic region. In either case, epididymitis may begin very soon after the development of urethritis. It arises from extension of the phlegmasic action, by continuity of mucous membrane and lymph-vessels, through the ejaculatory duct and spermatic canal, and thus reaches the epididymis. In some cases the phlegmasic action is most intense in the spermatic canal, and is even propagated by the lymph-vessels to the spermatic cord. In these cases there is sometimes little swelling or pain in the epididymis, while at other times the epididymis is much swollen, very painful, and accompanied by perididymitis, the pain extending to the inguinal region and even to the abdomen. These last are cases of superacute epididymitis.

A young man affected with superacute epididymitis complained, on or about the third day, of severe pain, extending from the testicle and spermatic cord to his abdomen, which soon became distended. This was the beginning of a sharp seizure of peritonitis, from which he, however, recovered. A little reflection as to the explanation of the attack of peritonitis led to the conclusion that the canal between the peritoneal cavity and the tunica vaginalis, formed in fœtal life by the descent of the testicle, had remained patent, and that the phlegmasia of the tunica vaginalis, consequent upon the epididymitis, had through this channel extended itself to the peritonæum. It is worth while to take into account the possible existence of such an anomaly in case of peritonitis arising in connection with epididymitis, though it is also possible for peritonitis to occur by transmission through the medium of lymph-vessels.

Phlegmasia of the epididymis may be developed slowly and gradually in six or eight days, or may be superacute and reach its height in twenty-four hours. It is often attended with febrile reaction and gastic disturbance—furred tongue, nausea, vomiting, etc. Ordinarily, however, it attains its maximum of intensity in the course of three or four days. Both testicles rarely suffer at the same time. The phlegmasic action may affect only that part known as the tail of the epididymis, may be extended to the body, or may be most intense in the head of the epididymis. This same phlegmasic process frequently involves one or both seminal vesicles. Suppuration is a very uncommon result of epididymitis. Resolution occurs on or about the third week; but there often remains some induration at one or two points at the head or toward the tail, or the whole of the epididymis becomes sclerosed, and finally shrivels. Epididymitis occasionally recurs several times in the course of three or four months on the same side, and sometimes on the opposite side—*orchite à bascule* (Ricord). These recurrences are apt to be owing to the existence of small abscesses in the substance of the epididymis.

One of the occasional consequences of bilateral epididymitis is sterility. This is owing to chronic phlegmasia of both spermatic canals, the acid pus destroying the spermatozoa. In some cases these canals become completely occluded by a gradual stenotic process, with destruction of the epithelium, or by pressure from without at the tail of the epididymis during the shriveling of a phlegmasic nodule.

Several patients who had suffered bilateral epididymitis married healthy women, whom they have never succeeded in impregnating. One of them married a second time, and his wife, a well-formed woman in excellent physical condition, had not become pregnant ten years after.

Didymitis and epididymitis are specialized because, in the first case, the phlegmasia sometimes scarcely affects the epididymis, but expends itself on the body of the testicle, and, in the second case, because often the spermatic canal is very little affected, and the body of the testicle is intact, while the epididymis is the center of the phlegmasic process. To warrant this specialization there are other reasons, among which may be mentioned that didymitis sometimes arises from direct violence to the body of the testicle, and that this didymitis is said to occur secondarily to parotitis and to variola without epididymitis.

Didymitis, consecutive to epididymitis, may be subacute, acute, or superacute. It may resolve in three or four weeks, may suppurate, may end in gangrene of the testicle in two or three days, or become chronic. Superacute epididymitis is almost always attended with perididymitis, and sometimes with parenchymatous didymitis. In either case there is true orchitis, all the divisions of the testicle being affected.

Subacute parenchymatous didymitis is attended with little pain, but is slow in resolving, and liable to recur every few weeks. These recurrences forebode the development of purulent foci in the testicle. After three or four recurrences of dull pain and a sense of tension in the testicle, the two layers of the tunica vaginalis become adherent anteriorly or laterally. This is evidence that an abscess is approaching the surface. It happens that in some cases a single abscess is formed, becomes encysted, and is not recognized until the diseased testicle is removed and cut open, when a central mass of cheesy pus is enucleated.

Acute parenchymatous didymitis, though very painful, the pain extending from the testicle along the spermatic cord to the inguinal and even to the lumbar region, generally resolves with the accompanying epididymitis, and very rarely suppurates. Sometimes resolution fails and the phlegmasia becomes chronic. The seminiferous tubules are then plugged with plasma, and the intertubular substance is soon involved, sclerosis and shriveling of the testicle ensuing. This is not an uncommon occurrence in cases of didymitis consecutive to parotitis. There is a type of didymitis in which the testicle remains indurated for many months, and finally breaks, by ulceration, through the bounds of its tunics and integument, and is extruded as a fungoid mass, named benign fungus, sometimes mistaken for syphilitic or for tubercular disease. Benign fungus occurs among persons whose health is much deteriorated by debauchery and its consequences. This so-called benign fungus consists of no other elements than those composing the testicle in a state of chronic phlegmasia, together with a covering of granulation tissue.

Superacute didymitis is of rare occurrence. It is attended with very great pain and much febrile reaction, reaching its maximum of intensity within forty-eight hours, when the fate of the testicle is decided, for after this the phlegmasic process is on the decline or the testicle is in a gangrenous state. The whole body of the testicle is affected, the intertubular as well as the tubular substance. Its form and size are unchanged, the fibrous tunic yielding no space for swelling, hence the occurrence of gangrene, the hardness, and the almost intolerable sense of tension experienced by the sufferer. Even when the testicle escapes gangrene it is likely to be otherwise injured, for it either suppurates or ends in chronic induration, sclerous degeneration, and shriveling.

THE TREATMENT OF EPIDIDYMITIS should be adapted to the degree of the phlegmasia and to the peculiarities of individuals. Fretful, hyperæsthetic, algophobic patients affected with the mildest epididymitis are sickened by what others regard as a minor degree of pain, and require to be tranquillized by free doses of the bromides or even of opium. Otherwise the mild cases need nothing more than rest and suspension of the testicle. Other patients affected with superacute phlegmasia, endangering the testicle, make little or no complaint, though they experience much pain. In these cases prompt antiphlogistic treatment and the closest attention are necessary to save the testicle.

Acute epididymitis demands free catharsis, rest in the horizontal posture, and the ice-bag for forty-eight hours, or perhaps longer. There are cases in which cold applications fail to relieve pain; in these, hot fomentations often have the desired effect in the course of a few hours. The testicle should then be swathed in a thick layer of carded cotton sprinkled with half an ounce of tincture of opium, and the whole well suspended. In case of phlegmasia of the spermatic cord with much pain, a small plaster composed of powdered opium (one drachm) and a sufficient quantity of water to make a thin paste should be applied over the inguinal canal, as recommended by Velpeau, after ten or twelve leeches have extracted as many ounces of blood from that region. As a general rule, poultices should not be used; they are particularly hurtful in cases complicated with scrotal dermatitis. When there occurs effusion of serum in the tunica vaginalis (acute hydrocele), attended with much pain, relief is very soon afforded by making fifteen or twenty punctures with an exploring needle, the serum escaping in the scrotal connective tissue. "Strapping" is worse than useless and is sometimes destructive to the testicle. The patient should be kept in the horizontal posture for at least a week, and the testicle properly supported during that time and for two or three weeks thereafter. When suppuration has taken place in any part of the epididymis free incision should be made without delay.

THE TREATMENT OF DIDYMITIS is essentially the same as that of epididymitis, except in the case of the superacute type, which demands more heroic antiphlogistic measures, beginning with the application of at least sixteen leeches in the inguinal region on the affected side. Then the ice-bags —one anteriorly, the other posteriorly, as suggested by Curling—should be used continuously night and day for four or five days. Sufficiently free doses of opium, or of morphine hypodermically, to blunt the senses and induce sleep, are absolutely necessary. The prime indication is to prevent the occurrence of suppuration or of gangrene of the seminiferous tubules. When the violence of the phlegmasia is expended, when the pain is relieved, the affection is to be dealt with as in the case of epididymitis. But when, in the course of thirty-six or forty-eight hours, the faithful use of ice and of the other antiphlogistic agents fails to subdue the phlegmasic process, and the sense of tension is rapidly increasing, a free incision should be made through the scrotum and tunica albuginea. This is imperative as the only means of increasing the space for swelling or of reestablishing the local capillary circulation and thus preventing necrosis of the seminiferous tubules. The patient has a right to the benefit of the doubt, if any doubt exist in the mind of the physician as to the expediency of the procedure at the particular time, by a prompt resort to this incision, for even a brief delay may be fatal to the integrity of the testicle. This seemingly violent mode of treatment was advocated about fifty years ago by Vidal (de Cassis), who afterward wished to generalize it in all forms of orchitis, and made incision of the tunica albuginea, and even of the parenchyma of the testicle, in four hundred cases. He was criticised with undue severity by Gosselin, who asserted that the incision scarcely ever extended beyond the tunica vaginalis, and that the relief experienced by some of the patients so treated was owing to the exit of serous fluid which had distended the tunica vaginalis and had been the chief cause of the pain. Vidal did, however, accomplish incision of the tunica albuginea and often found the testicle already necrosed. In such cases incision is surely indicated. Hernia of the seminiferous tubules is liable to occur after incision of the tunica albuginea, but better this than gangrene, for under favorable circumstances cicatrization follows, though the testicle is more or less damaged.

XI.

CONSEQUENCES OF ACUTE URETHRITIS CONTINUED; GONECYSTITIS, TRACHELOCYSTITIS, PYELITIS, SEPTICÆMIA, PYOSAPRÆMIA, AND RHEUMATISM.

THE investigations upon which is based the part of this conference relating to the seminal vesicles began in 1879, but were interrupted by other occupations, and were not resumed until the year 1889. The majority of the dissections exhibited were made during 1889, 1890, and 1891. The specimens for dissection were kindly contributed by a number of medical friends interested in pathology.

GONECYSTITIS—phlegmasia of the seminal vesicles—is of much more frequent occurrence than is generally supposed. It exists more commonly as a chronic affection, often associated with trachelocystitis and prostatitis, for both of which it is very frequently mistaken.

Most practicing physicians have had their share of cases of chronic urethral discharge accompanied with phenomena variously styled "genital hypochondriasis, sexual neurasthenia, diurnal spermatorrhœa, sterility, impotency," etc. The majority of these are cases of chronic gonecystitis. Their cure is very difficult, slow, uncertain, and sometimes impossible. It is not easy to persuade the patients that the disease is local and that there is no great danger of implication of other organs. Dwelling much upon and magnifying their infirmity, their moral condition is soon not a little impaired. They are often unheedful of good advice, and, after having "gone the rounds" of the regular profession, fall into the meshes of greedy charlatans, while some of them end their days in asylums for the insane.

In its acute type gonecystitis frequently occurs as one of the consequences of urethritis with orchitis. It is then very often overlooked, because the phenomena of the orchitis occupy so much of the attention of the patient that the subjective symptoms referable to the region of these vesicles are masked by those of the orchitis. Therefore, in order to ascertain the existence or non-existence of acute gonecystitis, it is necessary to put well-directed questions to patients suffering from urethritis and consecutive orchitis accompanied by abnormal sensations in the intrapelvic organs. Prior to the further study of this phlegmasia it may be advantageous to rehearse the main points of the anatomy of the parts involved.

THE SEMINAL VESICLES, PHYSIOLOGICALLY CONSIDERED, are diverticula of the spermatic canals serving as reservoirs of the semen in man and most of the mammalia, notwithstanding the opinion of John Hunter to the contrary. The assertion that the seminal vesicles are physiologically diverticula of the spermatic canals is based upon the following facts: The dilated part of the spermatic canals corresponding in longitudinal extent to the seminal vesicles is identical in structure with the seminal vesicles; the same kind of fibrous, muscular, and mucous coats exist in both; the mucous coat is rugous and reticulated and lined with the same kind of epithelium in both; the same kind of mucus is secreted by the same kind of mucous glands in both; certain expansions and diverticula are found in both; concretions abound in both; and both are tubular in character. The anatomical differences are: The tube of the vesicles is more convoluted than the spermatic canals; the walls of the vesicles are thinner than those of the spermatic canals; the caliber of the tube of the seminal vesicles is greater than that of the spermatic canals; and the seminal vesicles have twice as many pouches as the spermatic canals. Each vesicle is therefore only an extension of the spermatic canal. In some animals—the dog kind, for instance—there are no seminal vesicles, the slightly expanded extremity of the spermatic canals doing all that is necessary toward diluting the semen before it reaches the prostatic region of the urethra. The seminal vesicles of a horse dissected in 1890 do not consist, as in man, of a single convoluted tube with diverticula, but each vesicle is an oblong sac capable of containing at least two ounces of fluid. The mucous membrane is rugous at the posterior extremity of the sac; the remainder is smooth.

One vesicle lies on the right and the other on the left of the median line, each with a spermatic canal on its inner border, widely separated posteriorly and converging anteriorly to the base of the prostate, which is traversed by their excretory ducts, and to which their anterior extremities are closely united; the vesicles and accompanying spermatic canals forming two sides of an isosceles triangle, and being attached to the lower fundus of the bladder, with it rest upon the rectum. The close relations of the vesicles to the prostate, bladder, rectum, and peritonæum explain how these parts are liable to be reciprocally involved in disease. When, in health, the bladder is empty, the space between the posterior extremities of the seminal vesicles is two inches and three quarters in extent, but while this part of the bladder is thus increased in width it loses in antero-posterior extent, for the peritonæum descends to within half an inch of the base of the prostate; and in some cases even overlaps the base of the prostate. When the bladder fills up with urine the peritonæum ascends with it and this antero-posterior space is more than doubled, while the transverse—*i. e.*, the space between the posterior extremities of the seminal vesicles—loses three quarters of an inch.

Each vesicle has a proper fibrous tunic, and the two have besides a common fibrous envelope containing a considerable amount of smooth muscular tissue, which connects them superiorly with the bladder, while they are attached to the rectum by loose connective tissue. The vesicles derive their nutrition from branches of the inferior vesical and middle hæmorrhoidal arteries. Their veins are large, and form a plexus which pours its blood into the efferent veins of Santorini's plexus, and which renders excision of the vesicles so bloody and dangerous an operation as it has proved to be. The lymphatic vessels are abundant and end in two or three trunks on each side, which enter certain glands on the sides of the pelvic excavation. The nerves are derived from the hypogastric plexus.

The seminal vesicles are conical in general outline, their bases are rounded and in close proximity to the recto-vesical *cul-de-sac* of the peritonæum, and their apices are buried in the base of the prostate. They are slightly flattened superiorly and convex inferiorly, and when distended show very distinctly their convolutions, which are bound together by connective tissue. They measure five centimetres (about two inches) in length and when unraveled twelve centimetres (about four inches and three quarters) in extreme length, exclusive of their eight or ten diverticula. The caliber of the tube of the vesicles averages six millimetres. This tube, like the spermatic canal, is made up of three layers—an external fibrous, very thin layer; a middle, consisting of smooth muscular tissue, the thickest of the three; and an internal, mucous layer. The mucous layer is rugous, alveolar, lined with a cubical epithelium, and contains cæcal glands—such as are found in the terminal part of the spermatic canals. These glands are parallel to each other, are ordinarily single, but here and there are double, triple, quadruple, or even quintuple, converging to a common duct which opens between the rugæ, the clear mucoid substance they secrete serving to dilute the semen.

Each vesicle has its excretory duct, which, uniting with the spermatic canal, forms the common ejaculatory duct, which is about sixteen millimetres in length, slightly conical in form, and opening by a slit on each side of the veru montanum on the floor of the prostatic region of the urethra. The caliber of the common ejaculatory duct is about two millimetres at its upper extremity, decreasing to about one millimetre at its terminal extremity in the urethra, and is extensible to a considerable degree. Its parietes are very thin as compared with those of the seminal vesicle, and its mucous membrane is smooth.

The seminal vesicles, as is seen from their peculiar construction, serve the double purpose of reservoirs of the semen and of accessory glands to the genital apparatus, their alveoli, diverticula, and convolutions preventing them from completely emptying themselves during ejaculation. In them the semen is detained long enough not only to be diluted by their mucoid secretion, but for the spermatozooids to attain full maturity. In the semen of men given to excessive sexual intercourse, immature spermatozooids have been found still inclosed in their parent cells. This seems to sustain the view that the spermatozooids do not reach perfection until they have lingered for a time in the lower part of the spermatic canals and in the seminal vesicles.

Besides secreting the mucoid substance already referred to, the seminal vesicles contain certain very small calcareous concretions, few in number and not constantly found except in disease. Civiale mentions Carmann, Riedlin, Stalpart Vander Wiel, Hartmann, Meckel, Hemman, and Baillie as having cited examples of calculous concretions formed in the seminal vesicles, and likewise names Mitchell as having found two hundred small calculi, of earthy appearance, in the right seminal vesicle of a phthisical subject. Rokitansky also speaks of the presence of calculous concretions in the seminal vesicles. In addition to these calculous particles, there is a great abundance of other concretions, irregular in form and size, nearly colorless in health, amber-colored in disease, very friable, and resembling inspissated mucus. These last-named concretions, whose use is unknown, were carefully studied by Ch. Robin, who called them sympexia, which means concretions, and who thought them analogous to the concretions found in the thyreoid body, the spleen, the glands of the uterus, the lymphatic glands, and the prostate. These sympexia are found in great quantities also in the expanded extremities of the spermatic canals. Microscopic in dimensions, they are lodged in the alveoli of the mucous membrane, increase in size from phlegmasia of this membrane, and become sources of further irritation, and even obstruct the excretory duct, as observed in some of the specimens exhibited. In these specimens they vary from one to four millimetres in mean diameter, and among the specimens illustrating chronic gonecystitis many are oblong, like grains of rice, three by eight millimetres in dimensions. The large sympexia sometimes consist of aggregations of small concretions cemented by pus and imprisoning spermatozooids, blood, and epithelial cells. They fly to pieces on slight pressure.

The normal seminal vesicles of a man, aged thirty-nine years, who died of pneumonia, were carefully dissected and the contents of the left vesicle examined microscopically, with the following results: The fluid was viscid, of a brownish color, and consisted of mucus, with innumerable spermatozooids, spermatic cells, leucocytes, a few cubical epithelial cells, and great numbers of sympexia of a yellowish color, globular in form, some of them about half the diameter of red blood-corpuscles, others of nearly the size of red corpuscles. Here and there these sympexia were aggregated in masses from the one five-hundredth to the one three-hundredth of an inch in size.

The viscid, brownish contents of the seminal vesicles of a man, seventy-three years of age, who died of a head injury, examined microscopically, twenty-four hours after death, consisted of epithelial cells of different form; some were polygonal, some cubical, some oval; a few spermatic cells, many sympexia of amber-color, varying in size from one third the diameter of red blood-cells to the size of leucocytes; some of them were round, the majority polyhedral and irregular, and the smallest were often aggregated in masses of four, six, eight, or ten. No spermatozooids were discerned. Other observations gave similar results. The cubical character of the epithelium and the existence of mucous glands were verified in the vesicles as well as in the spermatic canals.

GONECYSTITIS does not appear to have attracted much attention until Lallemand published his observations of this affection in connection with "spermatorrhœa," which is often one of its phenomena, while some form of urethritis is almost invariably its exciting cause. Civiale, Vidal, Gosselin, Verneuil, Fournier, Rapin, and other authors, French, German, English, and American, have, to a greater or less extent, discussed the question of phlegmasia of the seminal vesicles in special essays, general surgical treatises, inaugural theses, or journal articles. Among the essays that have appeared in the last few years upon this topic is a paper with the title of Seminal Vesiculitis, by Mr. Jordan Lloyd, of Birmingham, in the *British Medical Journal*, April 20, 1889. Each of these writers has contributed his share toward the elucidation of the subject, but much remains to be done by other laborers.

Gonecystitis seems to occur with greatest frequency among men who habitually commit venereal excesses, and among those addicted to masturbation, either rendering the seminal vesicles more or less vulnerable. This vulnerability generally consists in abnormal expansion of the ejaculatory ducts, or in persistent erethism of their mucous membrane and that of the seminal vesicles. Acute phlegmasia of the urethra in such subjects is thus propagated through the ejaculatory duct to the seminal vesicle and spermatic canal on one or both sides, generally accompanying orchitis, but sometimes without the association of orchitis, just as orchitis often occurs without involvement of the vesicle. It arises most commonly as a consequence of chronic urethritis, but violent catheterism is not infrequently its exciting cause, particularly when a very small instrument enters or tears the ejaculatory duct.

In the acute types of gonecystitis the mucous membrane of the ejaculatory duct may be swollen to the extent of occluding its lumen, or a large sympexion may be dislodged from the vesicle, forced into, and plug the ejaculatory duct, so that in either case pus may accumulate and greatly distend the vesicle whose attenuated, or perhaps ulcerated, walls are finally perforated, possibly at several points, allowing this pus to infiltrate the ambient connective tissue and to form a vast abscess pointing in the direction of the ischio-rectal fossa, of the bladder, of the rectum, or even of the peritonæum. This process belongs generally to superacute or to acute phlegmasia. In the case of subacute phlegmasia there is a minor degree of swelling; resolution being slow or failing, there follows chronic gonecystitis, interstitial as well as parenchymatous.

In the chronic type there is sometimes ectasia of the vesicles, which contain large sympexia, as shown in several of the thirty-four carefully dissected specimens exhibited, or the vesicle shrivels sometimes in an extraordinary degree, as seen in three of the specimens, and becomes useless. One specimen illustrates three interesting points: occlusion of the right spermatic canal, shriveling of its accompanying seminal vesicle, and apparently compensatory enlargement of the left vesicle and spermatic canal. Another specimen also illustrates occlusion of the right spermatic canal, but probably of recent date, because the seminal vesicle does not appear to have undergone the shriveling process.

Interstitial is generally secondary to parenchymatous phlegmasia of the vesicle and is characterized by plastic infiltration of the intertubular connective tissue. Suppuration may take place primarily in the intertubular connective tissue, but this can occur only from the destructive action of a sudden and superabundant exudate. Generally the exudate becomes imperfectly organized, undergoes sclerous degeneration, and the vesicle shrivels. Sometimes the exudate is better organized and the vesicle remains large and is somewhat indurated. Several of the specimens presented illustrate this point and show both vesicles to be considerably enlarged, hard, and filled with large sympexia. The shriveled condition of the seminal vesicles is common in cases of prostatic enlargement demanding frequent evacuative catheterism of the bladder for several years, the patients having had repeated attacks of orchitis with involvement of both vesicles.

Of sixty dissections of the seminal vesicles made in cases of prostatic enlargement, three fourths of these vesicles were shriveled and hard. The remainder, though not diminished in size, were more or less indurated. In a few instances they were enlarged, and in one case they were cancerous. In a specimen recently dissected, both vesicles were found reduced to less than half of their normal size and were nearly as hard as cartilage. A longitudinal incision made into the left vesicle showed the lumen of its tube to be reduced to about two millimetres in diameter, except at the posterior extremity of the vesicle, where its walls were attenuated, translucent, and expanded into a cyst containing three grammes of limpid fluid. The right vesicle, which was not incised, presented the same external appearances as the left. The prostate was considerably increased in size, very hard, and had for several years impeded urination. The patient died in consequence of pyelonephritis.

The symptoms of acute gonecystitis so far observed are: Almost constant painful erections of the penis; frequent and painful ejaculations of semen mixed with pus and blood, until the ejaculatory duct is occluded, when spermatic colic occurs; pain extending along the urethra to the extremity of the penis (this, however, is an index of coexistent trachelocystitis); difficult, painful, and frequent urination; burning pain in the perinæum, at the anus, and at the lower end of the rectum; a sense of tension in the rectum; rectal tenesmus; and very painful defecation. Rigors and febrile reaction, and throbbing pains in the rectum indicate suppuration. Retention of urine sometimes occurs in case of great tumefaction of one or both vesicles.

The diagnosis of acute gonecystitis is arrived at by an analysis of the symptoms, by digital examination through the rectum, and by intra-urethral instrumental exploration. The digital examination reveals more or less tumefaction, heat, and tenderness in the region of the vesicles on one or both sides as the case may be. If the swelling is in the form of a single, hard, oblong tumor extending from the base of the prostate upward, backward, and outward, the presumption is that the phlegmasic process has not extended beyond the proper capsule of one seminal vesicle. If, however, there is a diffuse, doughy swelling extending beyond the median line, it is likely that both vesicles are involved, that perforation of their walls has taken place, and that the ambient connective tissue is infiltrated. When one vesicle only is involved in suppuration together with the prerectal connective tissue, the pus sometimes points in the direction of the ischio-rectal fossa. In such cases the digital examination indicates the lateral deviation of the abscess. The instrumental urethral exploration should be made first by introducing a gum catheter with the object of emptying the bladder. This done, a moderate-sized rectangular steel sound should be carefully introduced. Though the first catheterism may have given some pain, the moment the sound reaches and distends the prostatic region of the urethra and passes over the veru montanum the most acute burning pain is experienced and continues as long as the instrument is retained. Without loss of time a finger should be passed into the rectum and pressure made along the median line of the prostate in order to break up and cause the expulsion of a sympexion which may be plugging the ejaculatory duct. Several of the symptoms being common to acute prostatitis, the rectal and urethral explorations are necessary to distinguish acute gonecystitis from acute prostatitis. The connections of the ejaculatory ducts with the urethra, the seminal vesicles, and the spermatic canals explain how gonecystitis and orchitis may occur at the same time. But, as before stated, the phenomena of the orchitis are generally such as to mask those of the gonecystitis. It is therefore wise in most cases of orchitis to make by the rectum a digital exploration of the seminal vesicles, which, if found tender to pressure, swollen, and hot, should be treated accordingly.

In the treatment of the acute types of gonecystitis the chief indication is to prevent interstitial suppuration. For this end a similar course to that pursued in acute prostatitis should be adopted. After thoroughly cleansing the rectum, three or four leeches may be applied to its mucous membrane in the region of the affected vesicle, with the aid of a tube such as that recommended by Dr. Hughes, of Dublin, for leeching in acute prostatitis. When the well-gorged leeches have cast themselves away, irrigation of the rectum with warm water should be made until it is judged that a sufficient quantity of blood has been lost. If it is found impracticable to leech by way of the rectum, a greater number of leeches—ten or twelve—may be applied to the anal and perineal regions. Enough blood will thus be drawn to unload the congested prerectal plexus of veins. As soon as possible after either of these modes of local depletion, the lower end of the rectum should be packed with cracked ice. When the ice melts, the water is allowed to flow out, while the anus is stretched open for the introduction of more ice suppositories, a process to be repeated at least every hour while the patient is awake. These frequent applications of ice should be continued two or three days, and longer if necessary.

This antiphlogistic treatment is valuable only during the period of increase or of stasis of the phlegmasia. Begun later, it is apt to be worse than useless. If, however, it is employed at the right time and faithfully carried out, much suffering is prevented, and resolution is likely to be hastened. Otherwise suppuration occurs, and, to prevent the pus from finding an outlet which may be dangerous to the patient, the sooner a free exit is artificially given to this pus the better for his safety. The particular process of relief should be adapted to the condition of the individual and to the extent of the abscess. When it is ascertained by digital exploration that the abscess is not large but well defined on one side or the other of the median line, the presumption is that the pus has not passed beyond the boundary of the proper fibrous capsule of one vesicle. In such a case aspiration through the rectal walls is indicated. The parts should be brought to view by means of a Sims speculum, and a slightly curved aspirating needle, not less than two millimetres in caliber, should be thrust into the abscess and the cavity quickly emptied and then well irrigated with a warm sublimate solution (one to five thousand). A single aspiration may suffice; but in case the cavity refills, the aspiration and irrigation should be repeated. If from superacute phlegmasia there is reason to believe that much necrosis of the tissues has occurred, or if the pus has broken through all barriers and has already infiltrated the prerectal connective tissue, a Sims speculum should be introduced, and a free incision through the wall of the rectum should be made into the abscess, whose cavity should be well disinfected and lightly packed with a tent of antiseptic gauze. This dressing to be renewed every day. Whenever the abscess is large, and this is generally the case when it has been of very slow development, almost chronic, it is likely to point laterally toward the ischio-rectal fossa. In that case it should be reached by the way of the perinæum, as suggested by Mr. Lloyd. The incision may be central or lateral, and directed so as to avoid the urethra and rectum. In case of doubt—that is to say, in case, from the extent of the purulent collection, there is a suspicion that both vesicles are affected—it is wise to make a crescentic incision three quarters of an inch in front of the anal margin and deepen the cut by careful dissection between the rectum and prostate, care being taken to avoid wounding the urethra. After giving free vent to the pus, the abscess cavity should be disinfected and very loosely packed with a tent of antiseptic gauze, so that the healing process may begin at the bottom of the cavity.

CHRONIC GONECYSTITIS.—Though acute gonecystitis often resolves without suppuration, it becomes chronic in a considerable proportion of cases, while in a great majority of instances chronic gonecystitis begins independently of the acute types.

The common causes of chronic gonecystitis are venereal excesses and masturbation, both giving rise to chronic urethritis, which is the immediate cause.

The symptoms of the chronic are similar to those of the acute type, but the suffering is less, and there is no febrile reaction. One of the most constant symptoms is a burning, itching sensation in the perinæum, anus, and rectum, such as occurs in the acute type, but not so intense, though continuous in some cases, and very harassing month after month and year after year. Another phenomenon is painful spasmodic contracture of the anal sphincter. When a seminal vesicle is in a chronic phlegmasic state, there is often a persistent urethral discharge consisting of pus, a little blood, some epithelium, and a few dead spermatozooids.

Spermatic colic is another, though not very frequent, symptom of chronic gonecystitis. It is due to the lodgment of a large sympexion in the ejaculatory duct and consequent retention of semen, mucus, and pus in the seminal vesicle.

Pus intimately mixed with semen is regarded by Christian Smith as a pathognomonic symptom of chronic phlegmasia of the seminal vesicles. The only means, says Dr. Smith, of ascertaining the source of this pus is by examining the semen that has dried on the patient's linen after coitus or after an involuntary pollution. "The stain made upon linen by normal semen is of a uniform grayish-white with a darker border, which never contains any element of yellow, while in case of phlegmasia of the seminal tract the dried stain presents a more or less yellow coloring, either throughout or at the border, which is the most highly colored. When the pus originates in the urethral or prostatic crypts, its mixture is never so intimate as in the first case, and the yellow coloring shows itself in minute zones or in disseminated spots upon the gray stain."

Progress.—When, in the chronic type of gonecystitis, the ejaculatory duct becomes occluded, the secretions gradually accumulate and cause ectasia of the vesicle and sometimes also of the spermatic canal. Such cases are of rare occurrence, and their symptoms are not easily interpreted.

Dr. Nathan R. Smith, of Baltimore, reported in the *Lancet*, 1872, vol. ii, p. 558, with the title of Hydrocele of the Seminal Vesicle, a case of cyst of the left seminal vesicle which filled the pelvis and extended into the abdominal cavity to a point above the umbilicus, and was at first mistaken for retention of urine. The cyst was tapped by the rectum and ten pints of a brown serous fluid were drawn.

In four weeks the cyst filled again and was again tapped. This time it did not refill. Reference to this case is made by Mr. Lloyd.

A remarkable example of ectasia of the spermatic canal is recorded by Troussel-Delvincourt in the *Nouveau journal de médecine*, October, 1820. The right spermatic canal formed a cylinder measuring nearly two inches in diameter, soft, smooth, filled with a thick, pulpy, yellow material, similar to that of softened tubercle. The seminal vesicles contained a similar but less consistent material.

These two are very exceptional cases, the ectasia rarely exceeding twice the normal caliber of the vesicle and canal, as shown by the specimens exhibited.

Subacute and chronic phlegmasia sometimes end in calcareous infiltration of one or both vesicles and spermatic canals. Among the specimens exhibited is a good illustration of calcareous infiltration of the spermatic canals.

Since phlegmasia of the spermatic canal is ordinarily associated with gonecystitis, sterility is one of the sequels of the chronic type when both sides are affected, the spermatozooids being destroyed by the abnormal secretions of the spermatic canals and seminal vesicles. When the two spermatic canals or the two ejaculatory ducts are permanently occluded, impotency is the result, erection of the penis being imperfect and sexual desire finally extinct.

In elderly men, as seen by the results of the dissection of sixty pairs of seminal vesicles, there is often shriveling of the vesicles from chronic phlegmasia. In younger subjects the chronic phlegmasia is generally confined to the mucous membrane and the vesicles are more likely to be dilated and filled with large sympexia. In several of the thirty-four dissections first mentioned a sympexion was found blocking the ejaculatory duct. In these younger subjects the symptoms are ordinarily distinct, while in elderly persons they are frequently wanting, and the altered condition of the vesicles is ascertained only at the necropsy.

The treatment of chronic gonecystitis should consist in endeavors to cure the existing chronic urethritis, and in emptying the distended vesicle every day by pressure with the finger passed into the rectum. This may be followed by very warm enemata and the occasional use of rectal suppositories containing half a grain of belladonna extract and one grain of opium. From time to time the passage of a steel sound and digital pressure thereon through the rectum should be resorted to for the purpose of effecting the expulsion of sympexia from the ejaculatory duct. The process should be employed as well for purposes of diagnosis as for relief at the same time, the extraction of the sympexion allowing the distended vesicle to be emptied and relieving a painful spermatic colic.

TRACHELOCYSTITIS—phlegmasia of the neck of the bladder—having already been examined, needs now only to be named as a consequence of urethritis.

PYELITIS AND NEPHRITIS very rarely occur in consequence of acute urethritis and are generally indirectly caused by urethritis—that is to say, they are among the ill effects of imprudent treatment, such as the long continuance of balsamics in excessive doses, particularly copaiba balsam, which has been known to cause acute parenchymatous nephritis and pyelitis, and finally chronic diffuse nephritis with albuminuria. Balsamics can not be too cautiously employed in the treatment of urethritis. The use of copaiba, or any other balsamic, should be discontinued, and on no account resumed, in the cases which show their susceptibility to its toxic effects by a profuse exanthem, an urticaria, or a papular eruption on the face and body. These are the cases which are likely to be complicated with nephritis. Some observers think they have detected a mild subacute pyelitis in the majority of cases of urethritis, whether acute or chronic. May not this pyelitis be owing to the heroic treatment too often employed in the management of the several types of urethritis?

SEPTICÆMIA AND PYOSAPRÆMIA very seldom occur as consequences of urethritis.

Septicæmia—putrid infection of the blood—is due to the evolution of ptomaines or of leucomaines, the first being the product of bacterial ferments developed in parts of the body that have become putrescent from injury, the second indigenous to the body and evolved in disease independently of bacterial ferments. Septicæmia consequent upon urethritis is probably sometimes a leucomainal intoxication, and is manifested by a violent rigor with much constitutional disturbance in some cases of superacute urethritis. This intoxication may be so profound as to be uncontrollable. In all cases there is constitutional disturbance, but in the majority it is of comparatively minor intensity. The poison is apparently less virulent, but this lesser virulence is rather in degree than in kind. Nevertheless, the poison is very gradually eliminated, and the sufferer—pale, emaciated, and feeble—makes a slow, lingering recovery, convalescence requiring six or eight weeks. In the first-named type of cases the indication is to insure rapid elimination of the poison. To that end free catharsis, diuresis, and diaphoresis should be promptly established, and during the action of the remedies employed the vital powers should be sustained by stimulants and reconstituents. If these means are successful, the case may be managed as in the second type, which permits the more deliberate selection of agents likely to safely expedite the elimination of the poison. The cathartics should be replaced by aperients, and the diaphoretics and diuretics should be mild, but continued two or three weeks. Five grains of chloride of ammonium thrice daily, and ten minims of tincture of chloride of iron, both largely diluted, should be given from the beginning to the end of convalescence. The diet should be mild, but nourishing and easily digested. Milk at first, then more substantial food, and generous wines.

Pyosapræmia—putrid pus infection of the blood—differs from septicæmia clinically and pathically. Septicæmia often occurs before the formation of pus, while pyosapræmia may not be manifested until several weeks after the infliction of a wound or the formation of an abscess. In septicæmia there are generally no secondary abscesses. In pyosapræmia, infective thrombi swarming with micro-organisms are found in the neighboring veins and carried into the circulation to cause multiple abscesses, sometimes in the viscera, sometimes in other parts of the body distant from the point of injury. These thrombi contain great numbers of staphylococci and streptococci. The favorable cases are generally those in which the viscera have escaped contamination, and the thrombi have lodged in muscles or in superficial connective tissue.

Pyosapræmia occurs as a consequence of urethritis in case of a solution of continuity, as occurs from "breaking the chordee," or from some other injury, or in case of abscess in any part of the urogenital tract. In these two circumstances infective thrombi are formed in the ambient veins and their migration begins. Septicæmia is manifested by one violent rigor and much febrile reaction, while pyosapræmia is characterized by recurring slight rigors of short duration, with less febrile reaction than septicæmia. When death occurs in consequence of acute urethritis there is either septicæmia or pyosapræmia. It is almost impossible to ascertain the percentage of mortality from these causes, for such cases are very seldom reported.

A few years ago, at Bellevue Hospital, a death occurred, which may be regarded as an excellent illustration of pyosapræmia originating from urethritis. The subject of this affection was a boy, seventeen years of age, who was suffering from superacute urethritis and a consequent perineal abscess. He had slight recurring rigors and other signs of profound pyosapræmia, and died three weeks after his admission to the hospital.

RHEUMATISM as an occasional consequence of urethritis, occurring in a little less than two per cent. of all cases, was first specialized in the latter part of the last century (1781) by Swediaur and by Selle. Swediaur's chapter on the subject is short, bears the title of Arthrocele, Gonocele, or Blennorrhagic Swelling of the Knee, and begins as follows: "A very considerable swelling of the knee, sometimes of both knees and the heel at once, attended by excruciating pains in the joint, sometimes occurs in men after a blennorrhagia. These pains, accompanied by more or less symptomatic fever, continue for two or three weeks, and gradually go off, leaving a stiffness in the joint, which lasts for many months. The disease particularly affects young men who, after a debauch, have been infected with blennorrhagia, with which it seems to be intimately connected. . . . It is not very uncommon, for in the course of my practice I have seen six or eight cases, each of which came on about the eighth or sixth day of the blennorrhagia, and in every instance the discharge from the urethra was either sensibly diminished or totally suppressed. For want of sufficient observation, I have not been able to determine the character of this disease; but in all the cases which have come within my knowledge the disease appeared to partake of the character of gout, with this exception, that all the persons were about the age of twenty-three or thirty, that the color of the skin was not changed, and that the swelling bore handling without exciting pain. The swelling gradually disappears by the free use of diluting drinks and by frictions with the ammoniacal liniment. . . ." This laconic description contains nearly all that is now known of the gross pathology, ætiology, diagnosis, and therapeusis of the affection. Additions, but no subtractions, have been made to Swediaur's chapter by more than three hundred writers on the subject since his time.

The character of these additions is far from exhibiting a general consensus of views respecting the nature of "urethral rheumatism," which still remains unexplained.

A synoptical presentation of a few of these diverse views will answer the purpose of this conference.

Swediaur, Lagneau, and Cullerier attributed "urethral rheumatism" to metastasis, and the affection was afterward treated in accordance with that hypothesis.

There are others who thought "urethral rheumatism" to be the effect of the cubeb and copaiba treatment of urethritis. Still others, among whom are several French, English, and American writers, have regarded "urethral rheumatism" as one of the effects of pyosapræmia.

Féréol spoke of a blennorrhagic diathesis analogous to, but not identical with, the syphilitic diathesis, and of an acquired diathesis corresponding to an individual predisposition, which individual predisposition Fournier admits.

Tixier, who has written an extended essay on the subject, also believes in a blennorrhagic diathesis.

Bonnières asserts that arthropathy and blennorrhagia are nothing more than the expression of the same vice—the rheumatic diathesis.

Thiry believed that the so-called blennorrhagic arthritis is merely coincident with urethritis, without being related to it in the slightest degree.

It has been noticed that individuals suffering from "urethral rheumatism" are often affected with eczematous and other cutaneous eruptions.

Ample experience has shown that simple non-virulent urethritis is as liable to be accompanied by "urethral rheumatism" as the virulent species.

While Fournier, the highest authority on the subject, believes in the existence of a "blennorrhagic rheumatism," he admits that rheumatism arises also from non-venereal urethral phlegmasia, and for that reason gave it the name of "urethral rheumatism," which, after all, is no better than gonorrhœal, blennorrhagic, or genital rheumatism, and in reality means simply rheumatism of the urethra.

These views, the outcome of one hundred years of discussion of the question of rheumatism occurring among individuals suffering from genital phlegmasia, are all inconclusive, for they fail to explain the true nature of the affection, and seem to relate more to its phenomena than its essence.

Of the many arguments made to establish a distinctness of "genital rheumatism" from common rheumatism, not one seems to adduce evidence sufficient to warrant such specialization. Nor do the contrary arguments seem better founded. A critical examination of both sides of the question brings into bold relief their weak as well as their strong points. Both strive to prove too much and thereby injure their cause. Those who wish to specialize "genital rheumatism" make urethritis its essential cause, and assert that it has few if any of the characters of common rheumatism, though they acknowledge that it is sometimes acute, the great majority of cases being subacute, and often chronic and affecting the knee. They further acknowledge that it affects parts which are just as commonly involved in ordinary rheumatism, and some of the contestants even point out sequelæ which belong to ordinary rheumatism. They thus enumerate the parts affected in "genital rheumatism," arthritis, hydrarthrosis, and arthralgia of the large and small joints, bursitis, sciatica, myalgia, ophthalmia, and affections of the heart, of the membranes of the brain, spinal cord, etc. Those who take the contrary side say that the rheumatic manifestations are merely coincident and do not bear the slightest relation to genital phlegmasia.

It seems that the extreme views of both contesting sides should be rejected, because the assertion that genital phlegmasia is the essential cause of the rheumatism is not proved, and because it is not proved that the rheumatism bears no relation to the genital phlegmasia.

Is it not likely that the affection is ordinarily a subacute rheumatism, excited in a vulnerable subject by the genital phlegmasia, just as it might be excited by any other phlegmasia, and that it therefore does bear a distinct and close relation to its exciting cause ?

It is hoped that bio-chemists and patho-histologists will re-examine the lactic-acid and other questions, and ere long enlighten the profession respecting the essence of what is called rheumatism, and help to determine if its association with genital phlegmasia is or is not a coincidence.

Whatever may be the nature of the ailment commonly styled "gonorrhœal rheumatism," its treatment differs little if at all from that of acute or that of subacute rheumatism.

XII.

CHRONIC URETHRITIS; ITS NATURE, CAUSES, PHYSICAL CHARACTERS, DIAGNOSIS, AND TREATMENT.

THE nature and treatment of chronic urethritis for a long time greatly perplexed physicians, because the several pathic conditions which give rise to persistent urethral discharges had not been sufficiently well studied, and because the characters and sources of the discharges were not ascertained. These discharges were found to be so refractory to treatment that many empirical methods were used with little or no effect. It would be a waste of space to enumerate the many modes of treatment that have been employed during the past century. In speaking of this obstinacy of chronic urethral discharges, Ricord said to his disciples: "After having tried everything, try to do nothing"; for experience had taught him that meddlesome treatment only served to aggravate the phlegmasia, which he had often observed to subside soon after the cessation of all medication.

Although some light was thrown by Gubler upon the differential diagnosis of some of the lesions that cause chronic urethral discharges, little attention was paid to the teachings of his excellent essay on the anatomy and phlegmasiæ of the bulbo-urethral glands, which show that when a persistent urethral discharge of a clear and very viscid mucoid substance occurs, its source is surely in one bulbo-urethral gland or in both glands, but that when this viscid discharge is purulent there is chronic phlegmasia of the bulbo-urethral gland or glands. This clearly indicates that all urethral discharges are not necessarily signs of chronic urethritis. An acute urethritis may be cured and leave no other trace than chronic phlegmasia of a bulbo-urethral gland or of its duct. In some cases, instead of bulbo-urethral adenitis, chronic cryptitis is consecutive to acute urethritis; in these cases the discharge is very little viscid, but has the odor characteristic of the mucous secretion of the urethral crypts. In other cases chronic prostatitis or gonecystitis may be consecutive to the acute urethritis.

Mercier, who made a careful examination of the question of chronic urethritis, did much toward disseminating correct views respecting the pathology and treatment of this phlegmasia.

Next came the labors of Désormeaux, who demonstrated, with the aid of the urethroscope, true granular urethritis to be the most common cause of persistent purulent urethral discharge. From that time chronic urethritis has been very diligently studied, and other lesions have been discovered which give rise to chronic purulent urethral discharge, and at present the treatment is directed to the cure of the lesions that have been so well specialized.

NATURE OF CHRONIC URETHRITIS.—Chronic urethritis, attended with a slight muco-purulent discharge popularly named gleet, morning drop, military drop, etc., may be a termination of any of the acute types of urethritis, may begin as a benign urethritis, the first stage of the acute types, or may be developed far back in the urethra, be latent to the sufferer, and be discovered by the physician only by means of the urethroscope or of a microscopical examination of the urine. It should not be confounded with urethral blennorrhœa, true gleet. The difference between these two pathic conditions is worthy of note. Chronic urethritis is a phlegmasia of the urethral mucous membrane yielding a muco-purulent discharge, whilst blennorrhœa is the result of an excessive secretion of mucus by the urethral crypts or by the bulbo-urethral glands without the intercurrence of phlegmasic action, though it may sometimes be a sequel of phlegmasia. Frequent sexual erethism without copulation not infrequently causes a persistent blennorrhœa arising from excessive secretion of the urethral crypts and bulbo-urethral glands, the urinary meatus being constantly moist with mucus or with the very viscid secretion of the bulbo-urethral glands without admixture of pus. This is true gleet, unconnected with phlegmasic action.

The phenomenon, chronic urethral discharge, unless rightly interpreted, is likely often to lead astray both patient and physician. The inexperienced sometimes look upon chronic urethral discharge as always an indication of urethral stricture or of some sort of obstruction of the canal. A little reflection is sufficient to throw doubt upon such a view, if only on account of its want of proper qualification, a suitable qualification being to substitute often for *always*, and to say that chronic urethral discharge is often a sign of stricture, or is sometimes one of the early symptoms of stricture. Such a view would be indisputable. It is well known that a chronic urethral discharge may emanate from (1) phlegmasia of the seminal vesicles, (2) of the prostatic follicles, (3) of the bulbo-urethral glands, (4) or of the urethral crypts, as well as from (5) a circumscribed or a diffuse chronic phlegmasia of the urethral mucous membrane. It may be asked, How are these several discharges to be distinguished? The answer is as follows:

1. The discharge from the seminal vesicles contains sympexia and spermatozooids. Either distinguishes it from all the other discharges, even though it be mixed with them.

2. The discharge from the prostatic crypts is turbid, milky, and sometimes contains many prostatic sympexia and is very slightly viscous.

3. The discharge from the bulbo-urethral glands is known by its extreme viscidity; normally it is of crystalline clearness, but becomes opaque when containing pus.

4. The discharge from the urethral crypts is known by its peculiar odor, which it imparts to semen and which is called the seminal odor.

5. The discharge from a veritable chronic urethritis is muco-purulent and characterized by the profusion of pus cells it contains.

Chronic urethral discharge, no matter what may be its origin, is generally a source of much unnecessary anxiety to the patient, who thinks himself the most sorely afflicted of all mortals, and is almost incessantly watching the drop which he believes is forever to reappear. Of course it does reappear as long as he continues to irritate the urethra by "milking the penis" to find the drop when he thinks it is too tardy in showing itself. The morbid mind of the patient sees in this drop a virulent poison with which he is infected and which he is liable to transfer to any woman with whom he has sexual relations, and he has a vague notion that this poison may cause almost any disease. A medical friend related a case illustrating the ludicrous degree to which is sometimes carried the idea that a chronic urethral discharge from the man is liable to cause grave disease in the wife. The patient in question had been repeatedly told that his urethral discharge, consisting of clear mucus, was not contagious, but he always doubted the correctness of the doctor's view. However, he finally married and his wife soon became pregnant, but on or about the fourth month the abdomen was so much more distended than it would be even at full term that an examination was made which revealed a large multilocular ovarian cyst whose extirpation necessitated an extended median incision. The anxious husband, who had attributed this condition to infection by his urethral discharge, watched the operation with much solicitude, not on account of its gravity but of the fixed idea that he might be the cause of the disease. When he saw the enormous tumor, he said that if it had been a small lump he would have blamed himself, but that then he could not believe it possible for such a little drop to produce a growth of this size in the short space of four months.

Nothing is too absurd for the conception of some of the sufferers from chronic urethral discharges. They listen credulously to the ignorant and mendacious dicta of crafty and rapacious charlatans, while they are suspicious of honest physicians, and obstinately discredit rational advice and correct views. Many change their medical adviser as often as they do their erratic notions of the ailment which, owing to their own perversity, is destined never to be well. The difficulties experienced in the management of such cases are too well known to require extended commentary.

The ideas to be impressed upon the minds of patients suffering from chronic urethral discharges are: 1, That these affections are not contagious; 2, that virulent urethritis is generally cured within six weeks, but that in some instances several relapses occur, the last of which is almost certain to be followed by a slight but persistent muco-purulent discharge, liable even after four, five, or six months to increase so as to simulate an attack of acute urethritis, subsiding, however, in four or five days to the former few drops; 3, that not only is this chronic urethritis non-transmissible from the man to the woman, but, on the contrary, is most frequently aggravated by coition, even with a woman whose genitalia are sound and remain so after the coitus; 4, that the frequently reiterated assertion that a man who has once had virulent urethritis in his bachelor days, and marries years after the attack of urethritis, transmits "the gonorrhœal virus" to his wife, is without the slightest foundation; 5, that this irrational notion arose from belief in a "gonorrhœal virus similar to but not identical with the syphilitic virus"; and 6, that the correct view is that virulent urethritis is a local affection, and does not become constitutional.

THE CHIEF CAUSES OF THE PERSISTENCY OF URETHRITIS ARE:

1. *Disregard of hygienic precautions* during acute urethritis, or after its apparent cure. Sexual erethism of any kind, in thought or act, improper alimentation, the use, even moderate, of alcoholic or fermented beverages, over exercise, and excesses in general, all aggravate the acute type of the phlegmasia or, after it has begun to decline, cause its recrudescence, and finally the persistence of the stage of decline which constitutes chronic urethritis.

2. *Inappropriate treatment* of the acute types of urethritis—such as the so-called abortive treatment by injections of nitrate of silver in strong solution, or of strong solutions of any sort, by the abuse or the untimely use of balsamics, antiphlogistics, diluents, and baths—is among the prominent factors in the causation of chronic urethritis.

3. *Vulnerability of the subject*—that is to say, an inordinate susceptibility to phlegmasia, owing to the hyperlithuria so common among chronic dyspeptics, or to some diathetic influence, besides a constitution naturally feeble or impaired by disease or debauch—may be added to the ætical factors of chronic urethritis.

4. *Continued local irritation of the urethra* is another potent factor in the maintenance of urethral phlegmasia. This irritation may arise from frequent coition, from masturbation, from the existence of a stricture, from congenital

stenosis of the urinary meatus, from vesical stones, chronic cystitis, chronic prostatitis, gonecystitis, hæmorrhoids, anal fissure, eczema, etc.

5. *Excessive general and local treatment* of the acute types of urethritis both have the effect of prolonging the phlegmasic action—the first by disturbing the digestive function and enfeebling the patient and lessening his powers of resistance, besides causing grave complications. The large doses of balsamics long continued have a baneful effect upon the digestive apparatus, and often cause distressing cutaneous eruptions, hyperlithuria, and even nephritis. The too free use of alkaline diluents also tends to disturb digestion and otherwise defeat the objects for which these agents may be intended. The second, the untimely or the excessive use of urethral injections, is a prolific cause of the persistence of urethritis and of some of its complications and consequences. The too common tendency to treat the urethra as if it were not a part of the human body is owing chiefly to the want of proper interpretation of its morbid phenomena. It is over-distended, divulsed, or cut indiscriminately, simply because there is a discharge, and without ascertaining the nature of this flow. The idea that the discharge is a sure indication of the existence of a stricture is enough to induce the unthinking to over-distend, divulse, or cut the urethra. The patient, impressed with the notion that his case is unparalleled and demands extraordinary measures, consents to any proposed mode of treatment, even to the spilling of blood. He is then contented until he discovers that the urethral discharge is not cured by the

operation, and that the drop still obstinately obtrudes itself.

PHYSICAL CHARACTERS.—The alterations of structure of the mucous membrâne in chronic urethritis need to be studied during life by means of the bulbous bougie and the urethroscope, as well as by dissection after death, on account of their variations in character, site, extent, and depth.

In some cases the only perceptible lesion is congestion of the mucous membrane. This congestion is generally diffused over a space of two or three inches, involving the bulbous, membranous, and prostatic regions. It rarely involves the whole length of the urethra. Sometimes the membrane is congested in small patches from the balanic region backward.

Most frequently, owing to excessive epithelial exfoliation in the acute types and the consequent prolongation of the stage of decline, another condition is observable, and that is a granular state of the mucous membrane, designated as caruncles and carnosities by writers of the sixteenth and seventeenth centuries, and first demonstrated in the living by Désormeaux in 1864. This granular state is in reality an effort at repair. The denudation of the mucous membrane is more complete in some regions of the urethra than in others, notably in the bulbous portion of the canal, and there is a constant emigration of leucocytes, some of which become partly organized, forming the granulation tissue, while most of them are cast away as pus. Unless modified by treatment, the granular state continues indefinitely, and beneath the granulations, in the meshes of the mucous membrane, in the submucous connective tissue, and even in the spongy substance, is an exudate which in time becomes incompletely organized, sclerosed, and shriveled, constituting stricture. The exudate and granulation tissue may be distributed in multiple patches or may encircle the urethra. Such is one of the modes of development of urethral stricture from chronic urethritis, and this development is often the work of five, ten, twenty, or thirty years. The suppleness of the urethra is impaired wherever there are granulations with an underlying exudate. The bulbous bougie and the urethroscope reveal both conditions.

Another way in which urethritis is perpetuated is when a superacute urethritis has caused acute submucous urethritis. In such a case the alteration of structure is much more profound and rapid, sclerosis, shriveling, and stricture occurring in a few months and exciting a constant muco-purulent discharge which is liable to increase in thickness and quantity after the slightest imprudence, even to the simulation of acute urethritis.

A noteworthy circumstance is the frequent development of a very mild urethritis, with slight muco-purulent discharge, from what is commonly the first stage of the acute types. This form of urethritis has some of the characters of chronic phlegmasia from the first, it is attended by phenomena similar to those of chronic urethritis consequent upon acute urethritis, and is as persistent. In these cases there are the patches of granulation tissue, the submucous exudate perhaps only in a very slight degree, and in point of fact most of the lesions found in chronic urethritis that arises from the acute types; and stricture is one of the sequelæ of this form of chronic urethritis as much as it is of the ordinary chronic type.

When unchecked, chronic urethritis causes alterations of structure in the urethral mucous crypts and glands to the extent of sometimes destroying them. It is liable also to be propagated to the bulbo-urethral glands, to the prostate, to the vesico-urethral region, and even to the testicles. Long neglected, even the simplest form of chronic urethritis almost inevitably leads to stricture of the canal or to contracture of the vesical neck.

IN THE DIAGNOSIS OF CHRONIC URETHRITIS it should be remembered that all urethral discharges do not necessarily indicate urethritis. Thus a clear glairy discharge emanates from the urethral crypts without phlegmasic action, and likewise an extremely viscid discharge comes from the bulbo-urethral glands. A purulent discharge may come from the vesico-urethral region, from the prostate, or from the seminal vesicles. The true basis of the diagnosis of chronic urethritis rests upon a complete history of the case, gross and microscopical inspection of the discharge, and exploration of the urethra with the bulbous bougie or with the urethroscope.

If a patient, applying for treatment on account of a persistent urethral discharge, confess to one or two antecedent attacks of acute urethritis, it is fair to assume his present discharge to be the sequel of the acute urethritis, even if this attack of acute urethritis date back a few months or several years. But while this information helps, it is not sufficient to indicate the particular form and site of the existing chronic urethritis. The other aids to diagnosis, consisting in the use of instruments of precision, are essential to accuracy. The first of these aids to be used is the bulbous bougie. A No. 12 (English) bulbous bougie is ordinarily of convenient size for the purpose. This instrument is gently and slowly introduced into the urethra until the patient experiences a sense of tenderness and perhaps even of pain at a particular spot. The tender spot is generally a patch of granulation tissue covered with a layer of pus. The bulb is then carried onward about half an inch beyond the tender spot, where there may be neither tenderness nor pain, left in position for a minute, and slowly withdrawn. If the base of the bulb is coated with a whitish substance, this should at once be subjected to microscopical examination. If it proves to be pus, the granular nature of the tender spot may be considered as verified. In some cases the granulation tissue bleeds freely on the slightest provocation, and the bulb of the bougie is coated with blood. During the introduction and withdrawal of the bougie a delicate touch can discern a certain lack of suppleness of the urethra, particularly where there are several tender spots close together, or when a granular space with an underlying exudate encircles the urethral mucous membrane. This does well for urethritis anterior to the bulbo-membranous junction. If the examination is negative, all the anterior part of the urethra may be washed, and a bulb ous bougie carried beyond the bulbo-membranous junction into the prostatic region and withdrawn as before. A coating of pus upon the base of the bulb will indicate the site of the granulations and source of the discharge, or, after washing the anterior urethra, the patient is asked to urinate into two separate glass vessels. If the first urine contains pus and the second is free from pus, it may be inferred that the pus has come from the membranous or prostatic region. The urethroscope, however, brings to view the granulations, their extent and their exact locality, or reveals simply a congested state of the mucous membrane, diffused or in patches.

When a stricture has already formed, there is almost always behind this stricture a granular state of the mucous membrane, which yields a more or less abundant purulent discharge. This is perhaps what has led some observers to consider that a urethral discharge is the infallible sign of stricture. In point of fact, the discharge had long preceded the stricture and was one of the phenomena of the pathic state that caused the stricture—*i. e.*, granular urethritis with an underlying exudate, the urine, partly dammed, irritating the mucous membrane immediately behind the stricture and thus perpetuating the discharge. The cure of the stricture is followed by the disappearance of the granulation tissue and of the consequent discharge.

To TREAT CHRONIC URETHRITIS rationally and successfully it is essential to distinguish the several chronic urethral discharges, to ascertain the cause of the phlegmasia, its duration, the kind of treatment to which it may already have been subjected, and the physical condition, habits, and environment of each individual—in other words, to make a correct diagnosis. The mere gleet of clear urethral mucus requires no local treatment. It is particularly this gleet that is so excessively treated and by so many different cruel methods. The more it is treated the worse it becomes, and finally the heroic treatment leads to an almost incurable chronic purulent discharge. Wise hygienic management and avoidance of certain factors in the causation of oversecretion of mucus, such as sexual erethism, suffice to restore the urethral glands to their normal state.

The management of sufferers from chronic urethritis is attended with many difficulties, partly owing to the moral as well as the physical condition of the patient, partly inherent to the affection itself. Their treatment should therefore be moral, general, and local. Nothing will satisfy the patient except the cessation of the discharge. To bring this about is the chief indication, so far as the view of the patient is concerned, but to the physician the indication is not only to cure the local phlegmasia which gives rise to the discharge, but to prevent the formation of stricture.

The character of the moral management has already been hinted at in the beginning of this conference. In addition, it may be said that the physician should gain the absolute confidence and insure the co-operation of his patient, without which all treatment would be in vain. He should dissuade him from concentrating his thoughts upon and from continuing to magnify his infirmity, and, above all, should break his habit of stripping, squeezing, and "milking" the penis to bring to view the too tardy drop, for this alone is sufficient to perpetuate the discharge which might otherwise disappear even without local treatment.

The general treatment is directed to the improvement of the physical condition of the patient, to place him in the most favorable hygienic condition, to combat hyperlithuria, and to strive to remove some of the causes tending to perpetuate the phlegmasia. The use of balsamics in chronic urethritis is apt to be worse than useless, for these drugs almost invariably disturb digestion even in a short time. An exception may be made in favor of the oil of gaultheria, which sometimes acts as a very effective sterilizer of the urine in chronic as well as in acute urethritis; nevertheless this agent should be used with prudence and in doses of not more than five minims thrice daily. Another valuable sterilizer of the urine is salol used in moderate doses. Alkaline mineral waters should be given sparingly and for not more than eight or ten consecutive days.

The local treatment of chronic urethritis varies with the site of the urethritis, the particular alteration of structure, and the complications.

In case of simple chronic urethritis, in which there are no granulations or submucous exudate, but only congestion of the mucous membrane, diffuse or in patches, particularly when this congestion is limited to the "antebulbar" region, mild astringent irrigations are indicated. It is wise, however, to keep the patient under close observation for a week or ten days, and during that time to make no local applications whatever, for the general treatment may suffice to cure the urethritis. If then the discharge persists, the urethra, for the first five or six days, should be irrigated, only once daily, with ten or twelve ounces of a solution of boric acid or biborate of sodium, five grains to the ounce. Afterward chloride of zinc should be substituted, but the zinc salt solution should not exceed half a grain to the ounce. The quantity of fluid used for each irrigation should be about ten ounces. As a general rule, this form of chronic urethritis yields rapidly to the irrigations, and in the course of a few weeks is well.

In case of chronic cryptitis, the "antebulbar" irrigations of boric acid and afterward of zinc chloride should be made from before backward, so as to wash away from the crypts the accumulated muco-pus.

Chronic urethritis with granulations demands a somewhat different treatment, although in the beginning the irrigations with boric-acid solution should be used for several days. If the granular urethritis be "antebulbar," the best modifier that can be used is the nitrate of silver in solution of half a grain to the ounce, one grain to the ounce, and seldom increased to two grains to the ounce. The amount of fluid should not be less than six ounces, but should be used only once every four or five days.

In granular urethritis of the membranous and prostatic regions, particularly in case of coexisting chronic gonecystitis, the strength of the nitrate-of-silver solution may, with advantage, be increased to three, four, or even five grains to the ounce, and three or four ounces only need be used every four or five days. The bladder should contain a few ounces of urine in order to insure the quick decomposition of the silver salt. It is well known that when fluid is thrown slowly and without undue force through a catheter as far as the bulbo-membranous junction, it returns and escapes at the meatus, but that when the catheter is passed into the membranous region none of the fluid escapes externally, but all of it enters the bladder. Mercier pointed this out many years ago, and the experiences of other physicians have confirmed the view. Two days after each urethral irrigation a steel sound of moderate size should be cautiously introduced as far as the bladder. Too frequent catheterism or excessive dilatation only serves to defeat the objects sought to be attained. The sound should be carefully withdrawn in a minute's time, the purposes of its introduction being to make pressure upon the granulations, to slightly stretch the urethra at the seat of disease, and to restore the suppleness of the canal.

There are cases of granular urethritis that obstinately resist this treatment. These cases require direct applications to the granulation tissue, to accomplish which the use of the urethroscope becomes necessary. The granulations thus brought to view are penciled with a solution of nitrate of silver (ten, twenty, or thirty grains to the ounce) every four or five days until they disappear. Sulphate of copper and other substances have been used for the purpose, but are all inferior to the nitrate of silver.

Strong solutions are not well borne, are even mischievous, and therefore contra-indicated, in chronic urethritis anterior to the bulbo-membranous junction, but are well tolerated and effective when applied to the membranous and prostatic regions, where may be used with advantage the method of Guyon by the instillation of ten, twenty, or thirty minims of nitrate-of-silver solution (ten, twenty, or thirty grains to the ounce), to be in a minute washed into the bladder by a current of water, and repeating the process every three or four days. From Guyon's method good results have been obtained in otherwise intractable cases, particularly those complicated with chronic prostatitis, gonecystitis, or trachelocystitis.

Counter-irritation.—In certain cases of chronic urethritis involving the perineal or prostatic, or both, regions of the urethra, particularly those attended with dull pain and a constant teasing sense of irritation in the parts, counter-irritation of the perinæum by means of vesicating collodion is often of much service, and should be used every three or four days for several weeks. The vesicating collodion should be applied with a camel's-hair brush on one side of the perineal raphé, over a surface of half an inch by an inch and a half, and the perinæum covered with a layer of absorbent cotton, in order that the blistered skin may speedily heal. In three days the blistering process is repeated on the opposite side of the raphé, and so on every three or four days until the desired effect is accomplished.

When chronic urethritis is kept up by stenosis of the meatus urinarius, or of any other part of the urethral canal, it can be cured only after the removal of the obstruction to urination, in the first case by incision, in the second case by dilatation, divulsion, or incision, according to the character and particular site of the stricture.

In chronic urethritis due to urethral tuberculosis, no treatment other than the palliative is of any avail. The discharge increases in quantity from day to day, in it swarm the characteristic tubercle bacilli, and the patient soon succumbs to the inroads of general tuberculosis. A specimen exhibited showed tuberculosis extending from the meatus urinarius to the bulbo-urethral glands, spermatic canals, seminal vesicles, prostate, bladder, peritonæum, and right ureter and kidney. The left kidney had undergone compensatory enlargement and was not tuberculous. Both testicles had been extirpated, on account of tuberculosis, six months before the death of the patient. The specimen was a particularly good illustration of ascending tuberculosis of the urinary apparatus. There had been for several weeks a thick urethral discharge, in which great numbers of tubercle bacilli were detected. Several other specimens were exhibited to illustrate descending tuberculosis of the urinary apparatus. The disease, having begun in the lungs, secondarily affected the kidneys, descended to the bladder and urethra, and caused an obstinate purulent discharge.

ADDENDUM.

RETENTION OF URINE FROM PROSTATIC OBSTRUCTION IN ELDERLY MEN: ITS NATURE, DIAGNOSIS, AND MANAGEMENT.

THE following paper, read to the New York State Medical Association in October, 1890, is here inserted as a supplement to that part of the conference on cystitis which relates to the nature and management of retention of urine, because it gives more explicit directions in the use of the needed instruments.

While urethro-vesical obstruction occurs in young and middle-aged men from bladder and prostate stones, from acute prostatitis, from contracture of the vesical neck due to the extension of chronic urethritis, or from malignant disease of the prostate, it should not be confounded with the gradual and slow process of prostatic obstruction which rarely begins to impede urination before the age of fifty-five and is as rarely known to begin after the age of seventy.

CAUSES OF IMPEDIMENT TO URINATION.—To the question, What is it that causes this impediment to urination in elderly men? a common but incomplete answer is enlargement of the prostate. This answer is incomplete because of its failure to specify the kind of enlargement, for it is known that elongation and also uniform general enlargement of the prostate do not obstruct the urethro-vesical orifice or impede urination. Very large prostates have been discovered after death in elderly men who had never suffered the least inconvenience in urinating and whose bladders were in a normal condition. On the other hand, small prostates—*i. e.*, of even less bulk than natural, with only moderate increase of the lower isthmus—sufficiently obstruct the urethro-vesical orifice to give rise to stagnation of urine, cystitis, and even to complete retention of urine.

It is then only when the prostate is unequally enlarged that it interferes with urination, and to this even there are exceptions, for multiple tumors at its base sometimes cause true incontinence of urine, as do other forms of prostatic enlargement which prevent the closure of the urethro-vesical orifice and allow the urine to flow constantly from the bladder as fast as it trickles out of the ureters. In connection with this subject it may be said that enlargement of the prostate, conveying as it does only a general notion that the organ is in an abnormal state, needs to be specified, and it can ordinarily in some measure be specified after due observation of its immediate effects; for instance, an elderly man from whom normal urine is constantly dribbling and who suffers no other inconvenience presumably has true incontinence of urine due to some form of enlargement of the prostate which keeps open the urethro-vesical orifice, while another elderly man from whom fœtid purulent urine is constantly dribbling presumably has chronic retention of urine due to urethral or to urethro-vesical obstruction from some one of the forms of prostatic enlargement specified below, urethral stricture or the impaction of a calculus in the urethra having been excluded.

Of the several forms of unequal enlargement of the prostate which obstruct the urethro-vesical orifice the following only need now be named: (1) General enlargement with excessive development of the posterior third of the lower isthmus, called supramontanal portion by Mercier and third lobe by Home; (2) enlargement of the posterior third of the lower isthmus without apparent increase in the rest of the prostate, sometimes called centric enlargement; (3) enlargement of one lobe which encroaches upon the opposite lobe and obstructs the prostatic urethra; (4) unequal enlargement of both lobes, rendering the prostatic urethra tortuous and obstructing it; (5) multiple intra-urethral tumors; (6) intra-vesical enlargement of one lobe. Such are the principal forms of prostatic enlargement that impede urination.

These alterations of structure differ somewhat in their component elements. The majority of cases are diffuse leiomyomata, with a very small quantity of fibrous tissue accompanying the blood-vessels, and ectasia of the prostatic crypts, the sympexia of the crypts often dying and becoming coated with phosphate of calcium, and consequently increasing considerably in volume. They are those prostates which are softer than normal and which attain the greatest size. In some cases there are multiple circumscribed leiomyomata. Other cases are of diffuse and circumscribed inomata. They are the small, hard prostates which sometimes contain retention epithelial cysts. Adenomata are not so frequently found as are the myomata and inomata, and are circumscribed.

The first effect of urethral or of urethro-vesical obstruction is stagnation of urine in the bladder. The stagnant urine, even a few drachms, soon decomposes, and, acting as an irritant foreign body, gives rise to cystitis. The inflamed bladder then makes vigorous but vain efforts to expel this offending urine, in consequence of which its muscular coat increases in thickness. In certain cases the larger part of the stagnant urine is expelled, but the small quantity which remains is sufficient to induce such frequent spasmodic contractions of the bladder that the capacity of this organ gradually decreases until it is reduced to only two or three ounces. In other cases the bladder is dilated and capable of containing a quart, or even several quarts, of stale urine. In either class of cases, unless artificial relief be promptly obtained, the consequences are of the gravest order. The urine, thus dammed up, leads to dilatation of the ureters, ureteritis, pyelitis, nephritis, and death.

It may be asked, Is it possible to make a reasonably accurate diagnosis of these several kinds of prostatic obstruction? Yes, at least in four of the six just enumerated, and it is of no little practical consequence that they be differenced, for some of them require modifications in their surgical management.

The early manifestations of prostatic enlargement do not always cause anxiety and are often overlooked. The patient, having perhaps only vague notions of his condition, generally misinterprets the gradually increasing frequency of the calls to urination, does not perceive that his urine is slimy, pays little attention to the slight sensation of scalding during urination, is not aware of the significance of the changes in the mode of propulsion of the urine, notably the vertical direction of the jet, fails to notice the diminished size of the stream whose sudden cessation induces him to think that the act of urination is accomplished, when, to his surprise, more urine is expelled drop by drop, to be succeeded by the former perpendicular stream and again by the drops, and does not solicit the advice of his physician until all these symptoms are greatly intensified or until he is already distressed by complete retention of urine.

DIAGNOSIS.—Of the several steps in the diagnosis of abnormal urination and retention of urine due to prostatic enlargement, chiefly the following are employed:

The history of the patient's prior ailments, of his actual infirmity, and of his habits of life, having been obtained, an inspection of his general condition is made. His mode of urinating, if he can urinate, is noted, and his urine is duly examined. Then follows physical exploration.

The first step in this exploration is palpation, then percussion of the hypogastric region. If there is no tumefaction, if percussion is clear, it will be inferred that the bladder is empty or nearly so; and if at the same time it is noticed that normal urine is constantly flowing, it will be fair to infer that there is incontinence rather than retention of urine, although the involuntary flow of urine indicates oftener its retention than its incontinence; but if there is a rounded, tense, and painful tumor, dull or flat under percussion, and with this a constant desire to urinate, the inference will be that there is acute retention of urine. If, however, there happens to be a diffuse, slack swelling with fluctuation, also flatness under percussion, a dull instead of an acute pain, and no urgent desire to urinate, but slobbering of urine, the existence of chronic retention of urine will be inferred.

It is proper to state that, while percussion possesses some value in the diagnosis of retention of urine, it is not to be absolutely depended upon. For example, flatness on percussion does not necessarily indicate the presence of urine in the bladder, for, in the hypogastric region, flatness may be owing to a solid tumor in front of the bladder. Circumscribed flatness and fluctuation may indicate a pelvic abscess as well as stagnation of urine in the bladder, with more or less distention. Resonance on percussion does not indicate absence of retention of urine, for such resonance may be owing to the presence of knuckles of small intestine between a distended bladder and the anterior abdominal parietes.

The second step in physical exploration consists in making a digital examination of the prostate through the rectum, by which some idea may be formed of the size and consistence of the organ. As a general rule, hard prostates are little if at all enlarged, while soft prostates are large and sometimes attain enormous dimensions. By this same digital examination, the form as well as the size of the prostate is estimated. It may be simply elongated; one of its lateral lobes may be larger than the other; it may be uniformly enlarged; it may be nodulated, and this suggests the existence of multiple tumors; or it may not be larger than natural, but its apex may be rounded instead of being insensibly lost in the membranous region of the urethra. These are the principal circumstances to be noted from a rectal exploration.

The third step in physical exploration consists in ascertaining the particular kind of prostatic enlargement which affects urination. The exploration is made by introducing certain metallic instruments through the urethra into the bladder. This method was suggested and practiced by Mercier many years ago, and is as follows: A rectangular, short-beaked metallic sound (Fig. 1) or catheter is slowly introduced until it reaches the prostatic region of the urethra. If then the handle turns to the right of the patient, it is because the point of the instrument has been deflected by an intra-urethral projection of the left lobe of the prostate, and *vice versa.* If first to the right and then to the left half an inch or thereabouts farther back, it is because the point of the instrument is deflected first by a projection of the left and then by a projection of the right lobe of the

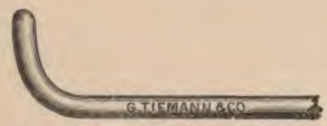

FIG. 1.—Mercier's rectangular sound.

prostate, showing unequal enlargement of both lobes. If the sound meets no impediment until it has nearly reached the bladder, and then its blunt heel encounters an obstacle, it is because there is enlargement of the posterior third of the lower isthmus (supramontanal portion, third lobe). By moderately depressing its handle and gently pushing the sound onward, it enters the bladder. Its beak is then reversed, and turned to the right and to the left in order to form some idea of the general character of the obstacle, if there be intravesical projection.

But for greater precision **the cysto-pylometer (Figs. 2 and 3) may be used. By means of this simple instrument the thickness of the obstacle can be accurately measured, and it can be ascertained if this consist of a crescentic valvule, of a "bar," or of a sessile or a pedunculated tumor.**

Fig. 2 represents the first cysto-pylometer devised by the author. It is so constructed that the vesical extremity of the male blade can easily override any urethro-vesical barrier without giving pain to the patient. This construction of the jaw of the male blade rendering the prehensile part a trifle too short, a new pylometer (Fig. 3) with the male prehensile part one third longer was lately contrived with the view of remedying the defect of the first instrument, but in this new pylometer the inclination of the jaw is so abrupt that it is necessary to observe the greatest care in opening the jaw of the instrument to carry the male part over a urethro-vesical barrier.

The several forms of prostatic enlargement already indicated give rise to acute and to chronic retention of urine.

Chronic cystitis ℞ i½ – O ii

Bichloride 1:10,000 O i = [illegible]

Boric acid ʒ i

Sp Gaultheria ♏ 20

Glycerine ʒ i

warm sol

Insert catheter & draw urine then inject what can be easily borne then let flow. then inject two half pint or injection. This is done every day until the quantity injected increases then the intervals can be lengthened

After the bladder has been dilated to hold 8 or 10 oz without pain & the urine still purulent Nit argent may be used twice a week one gram is dissolved in 8 oz distilled water then the urine drawn & the bladder washed twice with pure water then two injections of 4 oz each of the silver sol are given in 4 or 5 days this can be repeated but two grs silver to 8 oz water & the silver is increased every [illegible] days till 16 gr to 8 oz used

rance
char-
sense

FIG. 2.—The author's first cysto-pylometer.

FIG. 3.—The author's second cysto-pylometer.

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The several forms of prostatic enlargement already indicated give rise to acute and to chronic retention of urine.

By acute retention of urine is meant a sudden hinderance to the expulsion of urine from the bladder. It is characterized by great pain in, and an almost intolerable sense

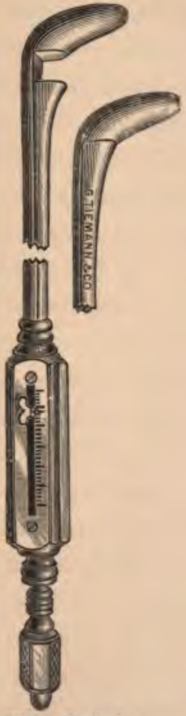

FIG. 2.—The author's first cysto-pylometer.

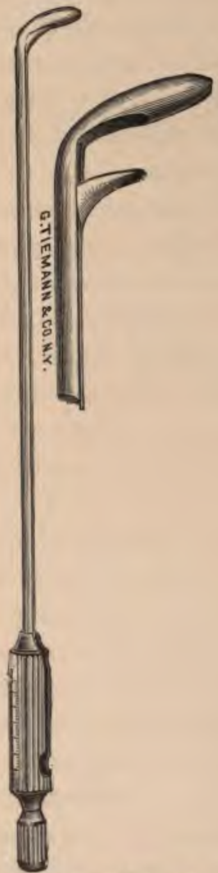

FIG. 3.—The author's second cysto-pylometer.

of distention of, the bladder; by a scalding sensation in the urethra; and by a constant desire to urinate which seems incessantly on the point of without being gratified.

Acute retention of urine occurs as well among elderly men with incontinence as among those who have no hinderance to normal urination, or only a very slight impediment—*i. e.*, the beginning of prostatic obstruction.

The mechanism of acute retention of urine is as follows: After exposure to cold, venereal excess, or a debauch, the pelvic vessels sometimes become so gorged with blood that the prostate swells, principally in the direction of the urethra and urethro-vesical orifice, to the extent of occluding the passage. This sudden engorgement is soon followed by exudations which do not always entirely disappear. Resolution is occasionally very slow, and even fails; the swollen prostate is then little, if at all, diminished, and acute retention may thus pass into chronic retention of urine.

Acute retention of urine is ordinarily preceded by dysuria for an hour or two. Urination is unduly frequent, irregular, scanty, and accompanied with scalding pain in the whole urethra until strangury occurs; then urine mixed with mucus and blood escapes only in drops at each spasmodic contraction of the bladder. Finally, a few hours after the exposure or debauch, comes ischuria. The patient is now unable to discharge a single drop of urine and is tormented with violent straining, which favors the escape of fæcal matter and even causes prolapse of the rectum. The passage being entirely occluded, the urine accumulates from hour to hour until the bladder is greatly overdistended and loses its power of contracting, generally for a time only, sometimes indefinitely. At the expiration of the first day the suffering is still very great, the patient becomes more restless, feverish, and thirsty; his face is congested from the constant straining, his skin is dry, and his intestines are distended with gas. On the second day the pain extends to the lumbar regions, and the dryness of the skin is succeeded by profuse perspiration having a urinous odor. The urine then begins to dribble, and this is delusive to the patient and to his family, who imagine that spontaneous relief has come, when in truth the urine is still accumulating in the bladder, a little only slobbering out from overflow. The consequence of this misinterpretation of a symptom is failure to invoke medical aid until it is deemed proper to repress what is wrongly believed to be a superabundant flow of urine. Meanwhile the patient lapses into a muttering delirium, his utterances being obscured partly by the extreme dryness of his tongue and mouth. The secretion of urine is now lessened (oliguria), and may soon be abolished (anuria), although the bladder is distended to the extent of four or five pints. In some cases the physician is not summoned until many nauseous, useless, and often hurtful nostrums and diuretics have been administered.

IN THE MANAGEMENT OF ACUTE RETENTION OF URINE, to temporize or to rely solely upon the use of medicaments in any case is to place the life of the patient in great jeopardy.

Having informed himself of the circumstances connected with the case and having made a preliminary examination, the physician selects the form of catheter best suited and forthwith introduces it, allowing the urine to flow very slowly, and every few seconds stopping up the distal end of the catheter. If called during the first twenty-four hours, he may empty the bladder at one sitting of three quarters of an hour, but if on the second day, he should draw off slowly only about one third of the contents of the bladder, and after this once every two or three hours he should introduce the catheter and allow more urine to flow, until in a day or two he finally empties the bladder, or he may leave in the catheter with its distal end closed and direct that six ounces be drawn off every two hours. The reason for these precautions is that the too precipitate evacuation of an overdistended bladder is sometimes followed by distressing and dangerous effects, such as profuse hæmorrhage from its mucous membrane and consequent general cystitis, polyury, etc.

The after-treatment should accord with the particular necessities of the case. The use of the catheter should not be abandoned until the patient is able to empty spontaneously his bladder, which should not again on any account be allowed to become overdistended. If the swelling of the prostate does not diminish, the use of the catheter should be continued indefinitely. In the mean time the urine should be kept bland by the internal administration of diluents, and the bladder should be irrigated once daily with a warm boric-acid solution, three grains to the ounce, with the addition of one tenth of peroxide-of-hydrogen solution.

By chronic retention of urine is meant a gradual and slow hinderance to the expulsion of urine from the bladder. Its characters are not generally perceived by the patient and are not always manifest to the physician, partly because this retention of urine does not become complete for many weeks or months, or even may never become complete. When incomplete it is at first characterized by much irritability of the bladder, which is constantly wrestling against the obstruction to force out the urine ; but this subsides in the course of a few months, when the sensibility and contractility of the bladder are somewhat impaired, as evinced by less painful, less urgent, and less frequent urination, and by the stream being small, feeble, frequently interrupted, and replaced by a succession of drops. When the retention is complete it is characterized by inability on the part of the patient to expel a single drop of urine.

As already stated, chronic retention of urine is the outcome of gradual, progressive, but ordinarily incomplete closure of the urethra or urethro-vesical orifice by unequal enlargement of the prostate which obstructs the canal. From being incomplete, this retention of urine becomes complete when the enlarged prostate further swells to the extent of closing the passage. It again becomes incomplete when from overdistention of the bladder the urethro-vesical orifice opens sufficiently to allow the urine to overflow and slobber out.

Grave errors are occasionally made in certain cases of extreme distention of the bladder from neglect to use the catheter as a means of diagnosis, for in elderly men the urine sometimes accumulates so slowly and gradually that the vesical distention causes little or no pain, or the slight pain is attributed to something else, and increases, in the course of weeks or months, to such an extent as to mislead the unwary. Such cases have been confounded with ascites, with abdominal tumors connected with the omentum, intestines, liver, or kidneys, with hydatids, with hydronephrosis, and even with fæcal impaction. In one instance a trocar was plunged into the abdomen, two inches below the umbilicus, the physician believing the case to be one of hydatid cysts, and seven pints of fluid drawn, which proved to be urine.

CATHETERS.—To the question, What is the most suitable catheter in cases of retention of urine from prostatic obstruction? the reply is that one catheter can not answer in all cases. The catheter should, as far as possible, be adapted to a particular kind of obstruction. Therefore the physician should be supplied with several very different catheters, and, after due exploration, as before indicated, be able to select one which is adapted to the particular deformity found in the prostatic region.

For exploration, the metallic instruments already described should be used, but after this, and for evacuative catheterism, metallic catheters should be avoided, for it is by their use that false passages are so commonly made. The most dangerous among these is the so-called prostatic catheter of great curve and extra length. The main difficulties in catheterism, as a general rule, are not due to increased length of the prostatic urethra, but to its several deviations; and a rigid catheter of great curve, even when used with caution, ordinarily fails to pass, besides being very apt to tear the urethra.

The catheters which are indispensable in the physician's armamentarium, all but one—*i. e.*, the soft, vulcanized India-rubber "velvet-eyed" catheter—consist of a tubular fabric of silk, coated with a pliable material, with a single eye close to the vesical extremity; the form of this extremity being in accordance with the particular use to which each instrument is designed. The most useful are the five forms indicated below.

The catheter (Fig. 6) woven upon a curved stylet is well adapted to cases of moderate supramontanal (centric) enlargement, or of urethro-vesical bars. When greater curvature is needed, as in a case of very large tumor of the supramontanal region, or when a false route impedes catheterism, a stylet may be inserted, and the catheter introduced after the method of William Hey. This efficiently replaces the so-called prostatic catheter. All the pliable catheters are from twelve to fourteen inches in length.

The olivary catheter (Fig. 7) is also woven upon a curved stylet; but the straight olivary catheter, very pliable for an inch from the point to the eye, is useful in cases of extremely tortuous urethræ from unequal enlargement of both prostatic lobes.

The elbowed catheter of Mercier (Fig. 4) is particularly well adapted to cases of intra-urethral tumors, of unilateral enlargement, or of unequal enlargement of both

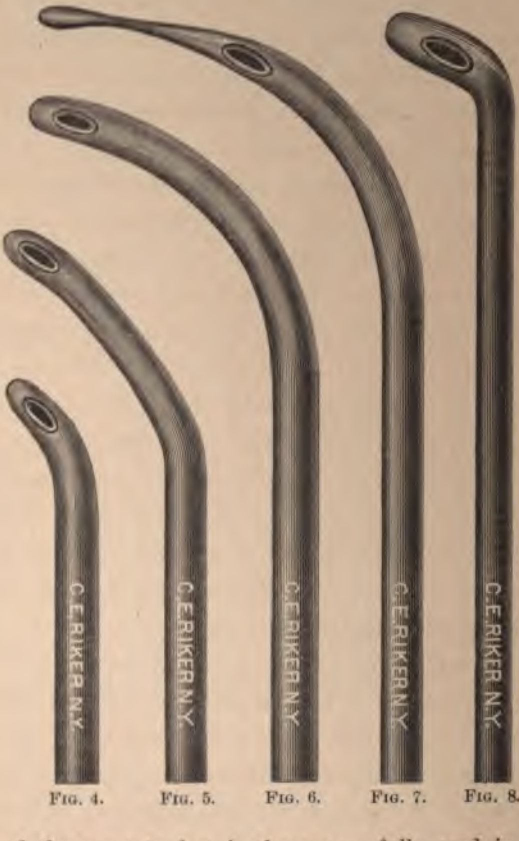
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Fig. 4. Fig. 5. Fig. 6. Fig. 7. Fig. 8.

lobes of the prostate, but is also successfully used in cases of urethro-vesical barriers.

The crutched catheter (Fig. 8), more angular than the elbowed, answers well in cases of great enlargement of the supramontanal region, the heel instead of the point of the instrument coming in contact with and gliding over the obstacle.

The double elbowed catheter of Mercier (Fig. 5) is adapted to cases of enlargement of the superior isthmus, together with supramontanal increase, causing great depression of the floor of the prostatic sinus.

Respecting the size of the catheters, the question, Should they be small or large? is very commonly asked. The answer is that they should be neither large nor small, but adapted to the particular urethra to be catheterized. A catheter of full size for a urethra under the average is too small for a urethra of extraordinary large caliber. A No. 14 (English) is small for the latter, and entirely too large for the former, to which a No. 7 (English) is likely to be much more suitable. These, however, are extreme cases. The most convenient size to the physician and to the patient, one that strikes a fair average, is No. 9 (English). It is rare to find urethræ that will not admit a No. 9, particularly in cases of stagnation of urine from prostatic obstruction, stricture being excluded. Many patients who are obliged to catheterize themselves labor under the delusion that small catheters are safest and give least pain. To the use of small catheters may be ascribed the majority of prostatic false routes and the frequent attacks of urethritis and orchitis from which auto-catheterists suffer. The best sized and safest catheter for each individual is the catheter that moderately fills and therefore does not stretch the urethra. Such an instrument gives less pain than the too large or the too small catheter.

The India-rubber "velvet-eyed" catheter is ordinarily the safest for general use by the inexperienced and for auto-catheterism, but its long-continued use upon or by the same patient is not advisable. The security felt by the patient is often a source of danger, for he is soon heedless of the precautions advised by the physician and suffers much in consequence. How much more frequently the physician is called upon to remove from the bladder fragments of or entire India-rubber catheters than of other firmer instruments! But, aside from these accidents, the urethra is often greatly irritated by the rubber catheter, not on account of this material itself, but of the carelessness, boldness, and undue frequency of its use, which come of its easy introduction. Painstaking, prudent, and intelligent patients soon acquire sufficient skill in the use of any of the several pliable catheters and learn to keep them in good order.

An important advantage of the India-rubber catheter is that it can be kept in an aseptic condition without injury to its structure. Very lately Vergne, a Paris manufacturer, announced that he has succeeded in making pliable catheters which are susceptible of being rendered aseptic withuot injury.

Puncture of the Bladder.—It frequently happens that the physician is called upon to relieve patients from retention of urine when ordinary catheterism is impossible by reason of false passages in the prostatic region. In such cases the common practice has been to make a suprapubic puncture with an ordinary trocar and insert a catheter or a silver tube, to be opened as often as necessary for urination. Twenty years ago capillary puncture with aspiration was introduced to the profession by Dieulafoy, and this novelty soon became the fashion. Many successful cases were reported, and capillary puncture with pneumatic aspiration was to be *the* operation in retention of urine. Although at first no reference was made to accidents, in a few years the vogue of the process was on the wane; now it is employed with more discrimination, and only to relieve extreme distention once or twice, and not ten, twenty, or thirty consecutive times in the same case. Capillary puncture with pneumatic aspiration is an excellent resource in medicine and surgery; it can not be too highly praised, but its abuse should be loudly decried.

THE INVAGINATED CATHETER.—No kind of puncture of the bladder ever can remove a false route, and capillary puncture is not so safe a process as was at first believed. The consequences of the escape of a few drops of urine in the prævesical connective tissue have been so disastrous in a number of cases as to deter cautious physicians from employing this method of relief except under circumstances of the greatest urgency; but there is an equally forcible objection to its general employment—to wit, a simple, safe, and efficient procedure has existed for the past forty years. Why it has not been more frequently employed is not apparent, but it is nevertheless valuable. In the year 1850 Dr. Mercier published in the *Union médicale* an account of his invaginated catheter for use in cases of prostatic false routes. Descriptions and drawings of the instrument have appeared in different books and periodicals, but little heed seems to have been otherwise taken of this precious device. It may be fairly stated that in ninety-five per cent. of cases of prostatic false routes the invaginated catheter can be successfully applied. The instrument (Fig. 9) as now made consists of two catheters—one metallic, the other non-metallic. The first or female part is a thin-walled No. 10 (English) silver catheter eleven inches long, very slightly curved, and having in its concavity, about half an inch from the point, an oval eye five eighths of an inch in length and three sixteenths in breadth. From the vesical extremity of the eye is an inclined plane, which is lost in the floor of the opening at the distance of a quarter of an inch, serving to tilt up the point of the male part. This male part is a flexi-

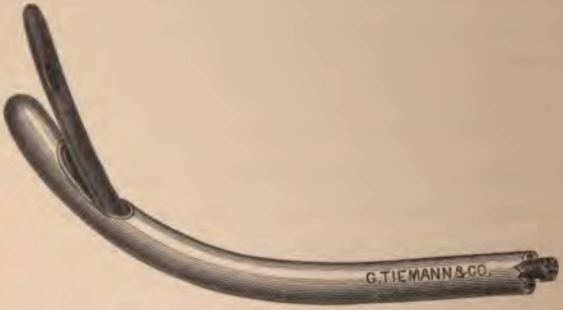

Fig. 9.—Mercier's invaginated catheter.

ble but firm "gum" catheter (No. 7 English) eighteen inches long, fitting loosely in the lumen of the female part, and having a single eye an eighth of an inch from its point. The way to use the invaginated catheter is to introduce the male into the female part as far as the eye of the latter, then to pass the instrument as far as the obstacle and engage the point of the metallic part in the false route, and finally project the male part, which will override the false route thus blocked and enter the bladder. If no urine should flow, it would be owing to closure of the eye of the male part by a blood-clot, which might be forced out by the injection of a little water through the male catheter. The female part can then be withdrawn and the male left in as long as may be required; this is the reason for the increased length of the male part.

In twenty cases the author has resorted to divulsion of the prostatic false route during catheterism with the invaginated catheter. This process, though comparatively easy, is not advisable except in the most experienced hands. While the immediate result has generally been good, it has not been lasting, for he has not known spontaneous urination to continue more than two years in any case after this operation.

The management of ordinary cases of chronic retention of urine from prostatic obstruction, without false routes, may be summarized as follows: Catheterism having been successful, only a part of the stagnant urine should be drawn off, and the bladder not completely emptied for a day or two, and sometimes not for a week, but the quantity of retained urine should be lessened every day. Then the bladder should be daily washed. In many cases it is not wise to begin at once with irrigations, or to use them too frequently. Bladders that have long contained purulent, slimy urine do not bear the contact of limpid fluids of low specific gravity well at first. It is therefore necessary to increase the density of the water used for vesical irrigation in such, and, indeed, in the great majority of cases. A good formula for vesical irrigation is the following, after dilution of one in twenty:

℞ Hydrarg. chloridi corrosivi........	gr. v;
Ammonii chloridi...............	gr. xx;
Spir. gaultheriæ.................	fl ℥ ss.;
Acidi borici....................	℥ j;
Glycerini	fl ℥ viij. M.

To half a fluidounce of this solution are added eight fluidounces and a half of warm water (110° F.) and one fluidounce of peroxide-of-hydrogen solution.

These ten ounces of fluid are sufficient for four washings of two ounces and a half at each sitting. Only in very exceptional cases should the bladder be irrigated more than once a day. After the bladder has been completely emptied, evacuating catheterism should be employed every five or six hours, except in cases of contracture with diminished capacity, when the catheter may be needed every two hours. In these cases it is necessary to resort to gradual hydraulic dilatation, a very delicate operation, which is successful when there has not been too long continued cystitis with connective-tissue sclerosis.

The general treatment in cases of stagnation of urine should be conducted in accordance with sound hygienic principles and little else. Opium, belladonna, or hyoscyamus should be used only to relieve extreme pain and spasm. The urine should be kept bland by the use of diluent beverages and the rectum completely emptied every day, for, next to stagnant urine in the bladder, the accumulation of fæces in the rectum is the greatest source of discomfort. A little generous wine at dinner, and a drink of brandy or whisky and water at bed-time, may be allowed without fear of causing local irritation; it is only in excess that alcoho is hurtful in these as in all circumstances.

Elderly men, and even young men, suffering from vesical disease are prone to constipation, and this too often remains undiscovered until the patient's life is imperiled by the local mischief arising from impacted fæces in the colon and rectum, or by the baneful effect of stercoral intoxication. Due appreciation of these evils naturally leads to an early inquiry directed to the state of the function of defecation. A common reply of the patient to this inquiry is that his bowels are regular, and yet a little cross-questioning reveals the fact that he has had no alvine evacuation perhaps for three or four days, or that the fæcal discharges have been scanty and hard for several weeks. Therefore a cathartic, or an enema with a liberal amount of ox-gall or of glycerin, should be prescribed in any case where there may even be the slightest doubt, and in nearly all cases the frequent use of aperient medicines is indicated. A surgeon of large experience, who flourished in this city during the second quarter of the present century, when called to minister to cases of retention of urine the nature of which seemed doubtful, was in the habit of saying to his assistants: "Order a copious enema and wait." It often happened that nothing more was needed, the enema having removed the impacted fæcal mass which had been the cause of the urinary retention.

THE QUESTION OF PROSTATOTOMY AND PROSTATECTOMY, internal and external, will not now be discussed, but a few words will be said of circumstances under which a portion of the prostate may be excised during suprapubic cystotomy for a tumor or stone. When epicystotomy has become necessary for the extraction of a stone or the ablation of a morbid growth, it may be proper to excise a portion of the prostate or a pedunculated prostatic tumor projecting in the bladder and interfering with urination. Pedunculated

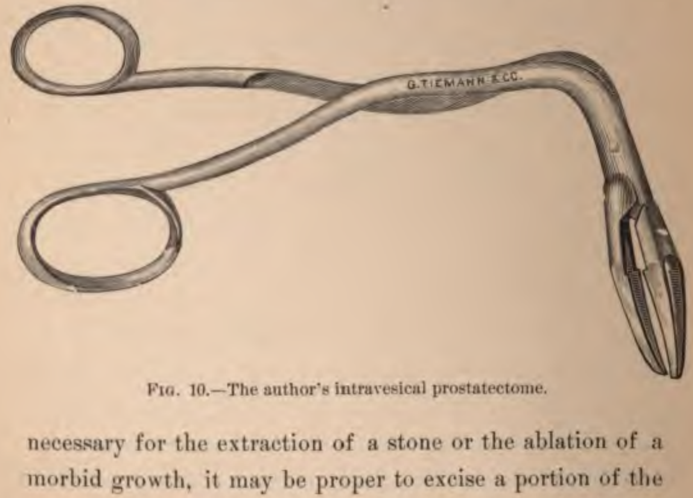

FIG. 10.—The author's intravesical prostatectome.

tumors can be excised by means of scissors with rectangular blades; but if a bar or median outgrowth is to be cut the rectangular intravesical, suprapubic prostatectome (Fig. 10), constructed on the principle of the hawk-bill scissors of Dr. Skene, will be found to answer the purpose of excising as considerable a portion of the prostatic obstruction as may be desired, leaving a V-shaped chink for the escape of urine, or, with a later instrument, a U-shaped chink.

The removal of a urethro-vesical tumor of the prostate during suprapubic lithotomy was done about half a century ago by Amussat.

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